



NEW OPHTHALMOLOGY COURSE
AFCM 2023-2024

**PEDIATRIC EYE DISEASE
AND STRABISMUS**

VISUAL MILESTONES

(reading)

- 1 month: Fixation is central, steady and maintained, can follow a slow large target with preference of looking at face.
- 3 months: Binocular vision and eye coordination start, eyes follow a moving light or face, responsive smile
- 4-6 months foveas fully developed
- 6 months: Reaches out accurately for toys.
- 2 years: Picture matching
- 3 years: Letter matching of single letters
- 5 years: Snellen chart by matching or naming

DD IN PEDIATRIC POPULATION

Red eye in children

- Ophthalmia neonatorum
- Nasolacrimal obstruction
- Acute and chronic Conjunctivitis
- Episcleritis
- Uveitis in children

Loss of vision

- Developmental cataract
- Buphthalmos
- ROP (retinopathy of prematurity)
- Retinal dystrophies (Leber's amaurosis)
- Optic neuropathies

DD IN PEDIATRIC POPULATION

Congenital corneal opacities

- Buphthalmos
- Forceps injury of cornea during delivery
- Mucopolysaccharidosis
- Congenital corneal endothelial dystrophy
- Congenital syphilis, measles

Leukocoria

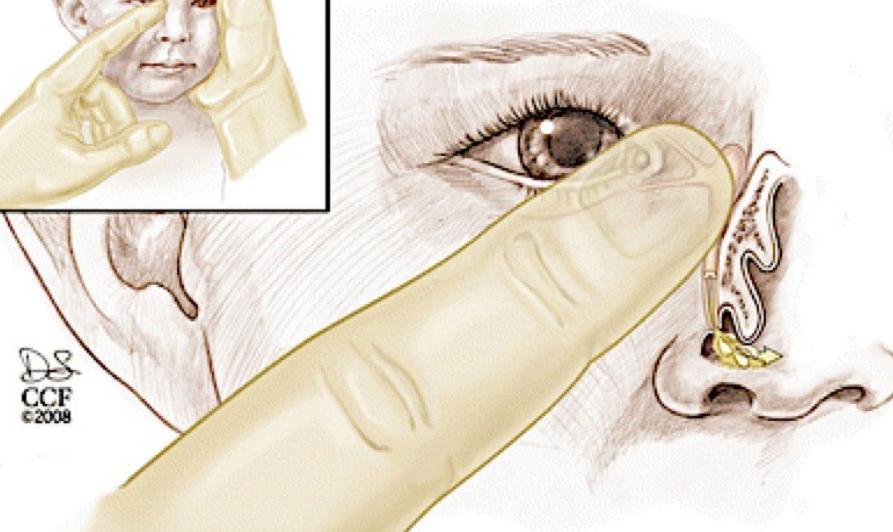
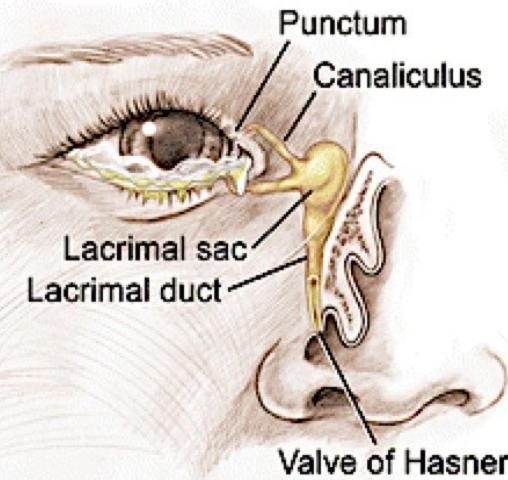
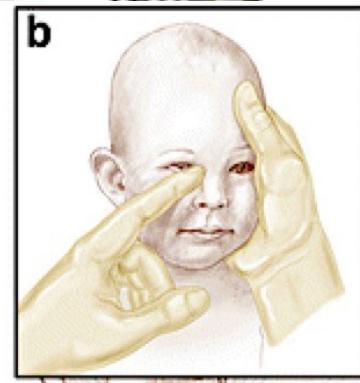
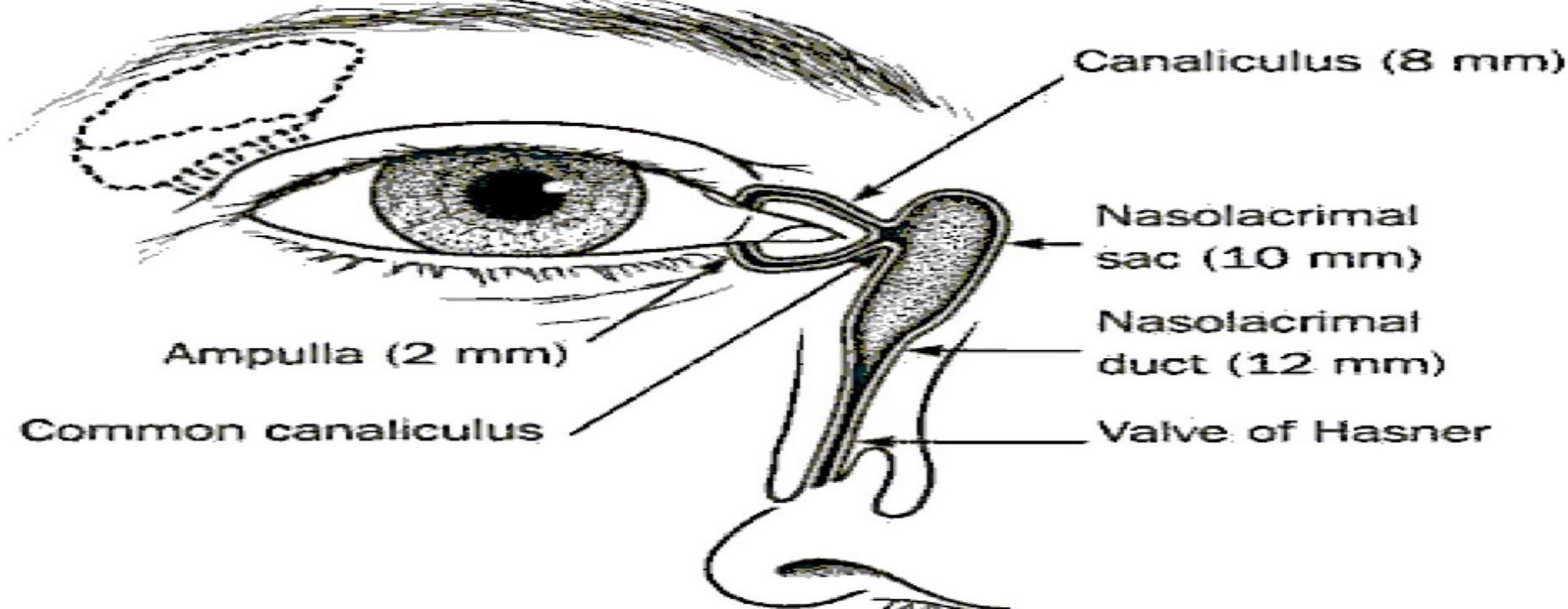
- Retinoblastoma (most serious)
- Congenital cataract (most common)
- Retinopathy of prematurity
- Toxocariasis
- Other rare causes (Coat's disease)

OPHTHALMIA NEONATORUM

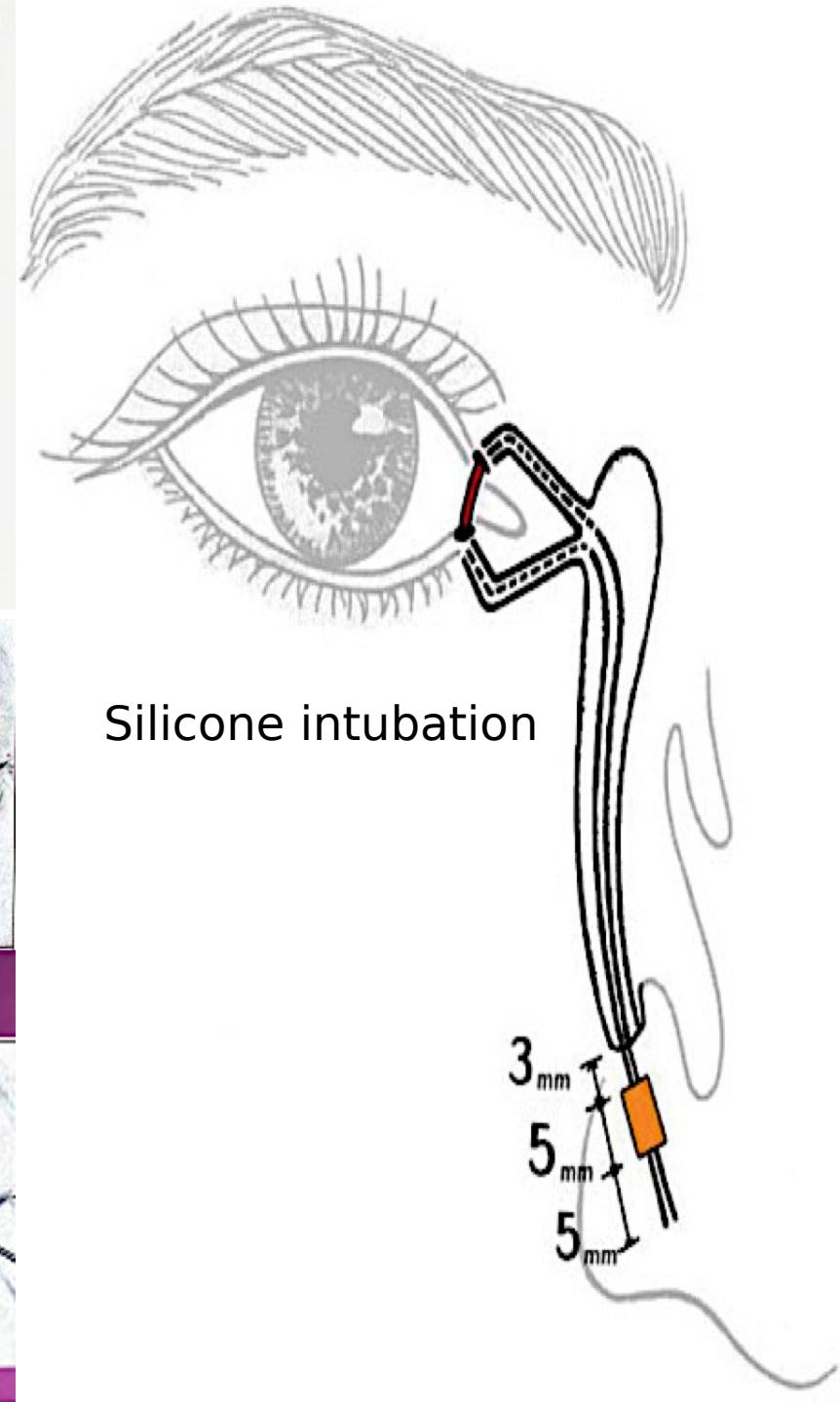
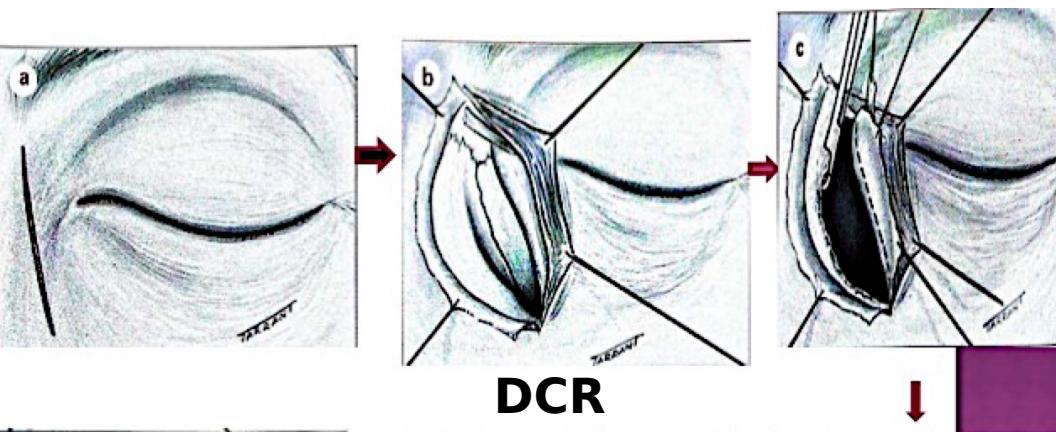
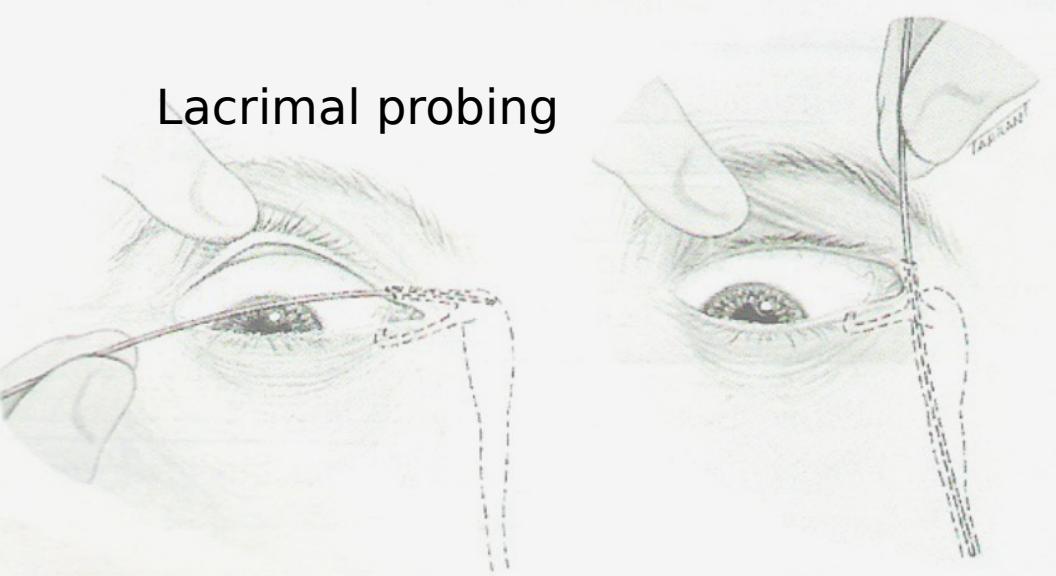
- Conjunctivitis in the first month of life due to organism acquired from birth canal or attendants
- Chemical from **prophylactic eye drops**
- Bacterial esp. **gonococcus** IM ceftriaxone (profuse purulent discharge and lymphadenopathy)
- **Chlamydial** oral erythromycin
- Herpes simplex esp. type II (rare)
- **DD** congenital nasolacrimal obstruction
- Don't forget prophylaxis!!

CONGENITAL NASOLACRIMAL OBSTRUCTION

- Common problem of newborn
- Normally nasolacrimal duct canalizes around birth, sometimes blocked by epithelial debris or imperforate **HASNER'S VALVE**
- USUALLY **UNILATERAL** lacrimation/discharge one week after birth
- 70% resolve within 1 month
- Treatment if persistent:
 - Conservative ttt with **topical antibiotics** and **sac massage** till 12 months (90% cure)
 - if persistent > 12 months then **Lacrimal probing** is then done
 - **DCR** can be done at 4 years if needed.

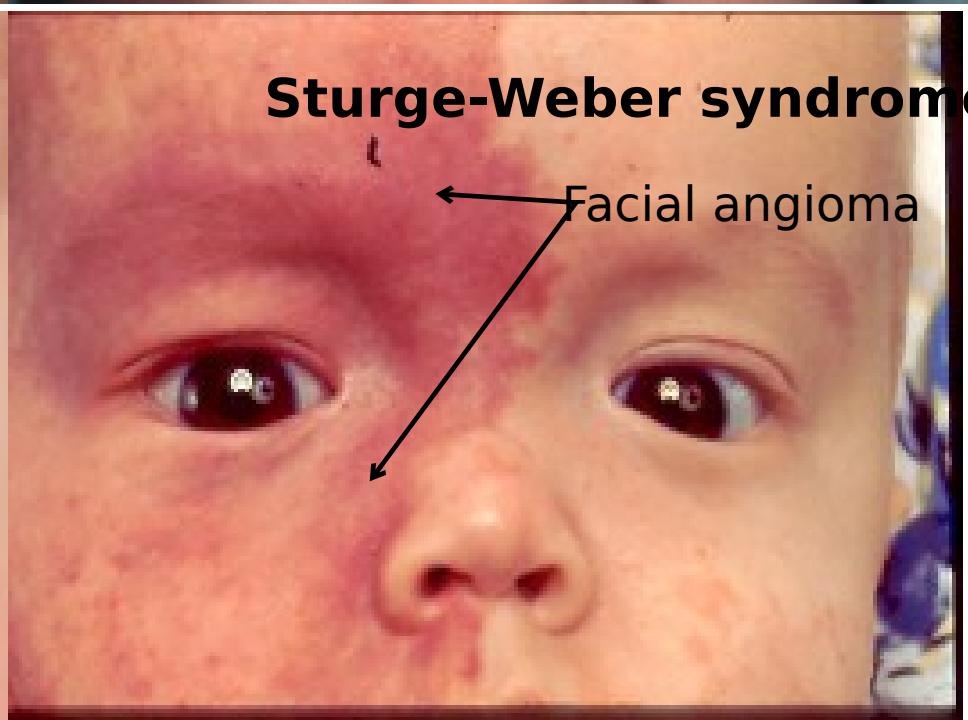
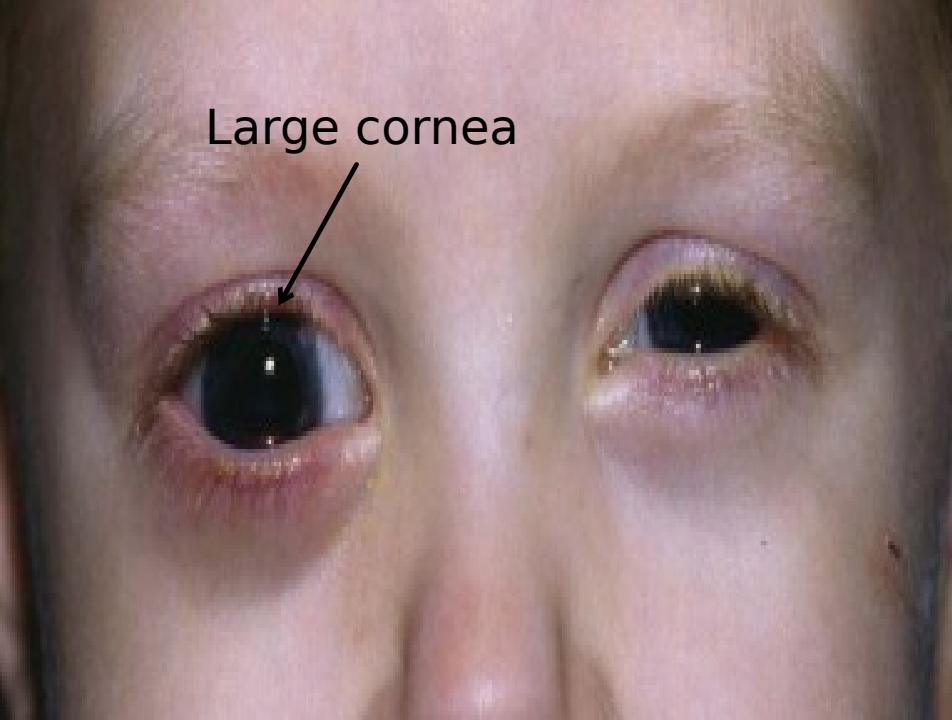


Lacrimal probing



CONGENITAL GLAUCOMA (BUPHTHALMOS)

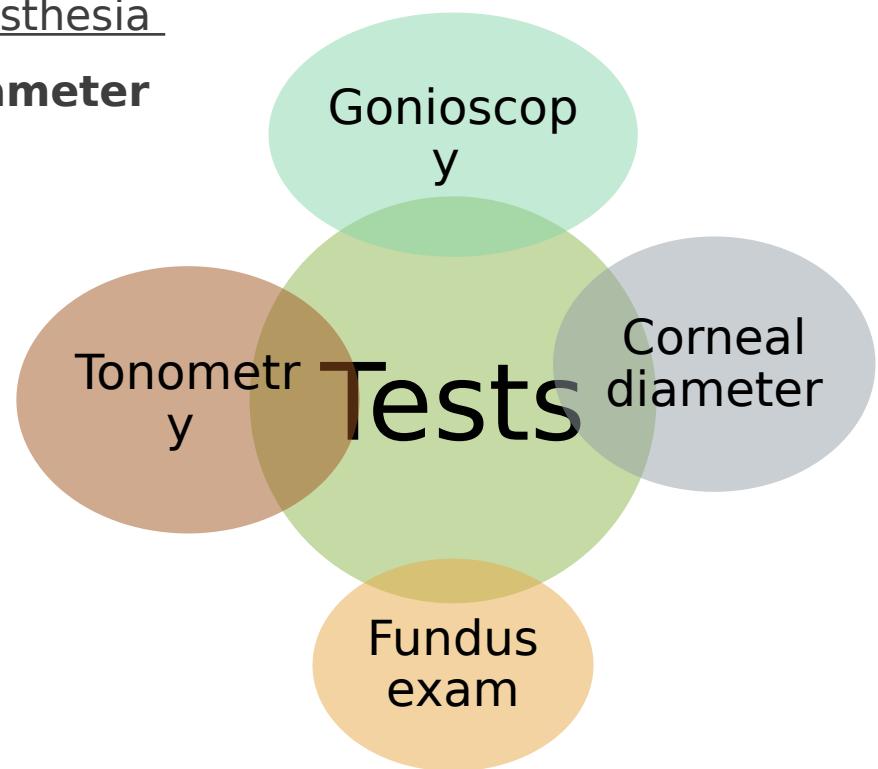
- Buphthalmos (bull's eye) is progressive enlargement of the globe because of congenital or infantile rise of IOP (glaucoma) due to **elastic outer coat**.
- The corneal diameter progressively increases from 10.0 mm normal at birth to 11.0 - 13.0 mm and more
- Finally the cornea starts to **opacify** because of endothelial dysfunction



- Symptoms:
 - **Early:** Lacrimation, photophobia, blepharospasm
 - **Late:** large eye & hazy cornea
- Signs:
 - Cornea : large, edematous (hazy).
 - High IOP
 - Fundus: cupping. we must exclude retinoblastoma!!

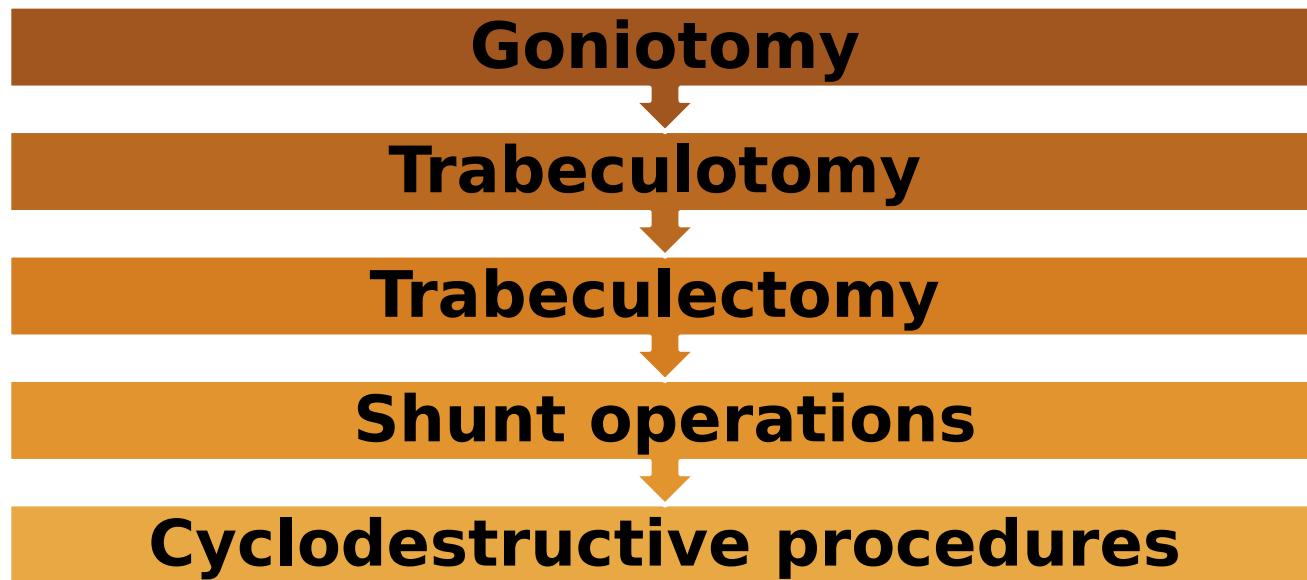
DIAGNOSIS:

- IOP measurement under anesthesia
- measurement of **corneal diameter**
- Fundus examination**



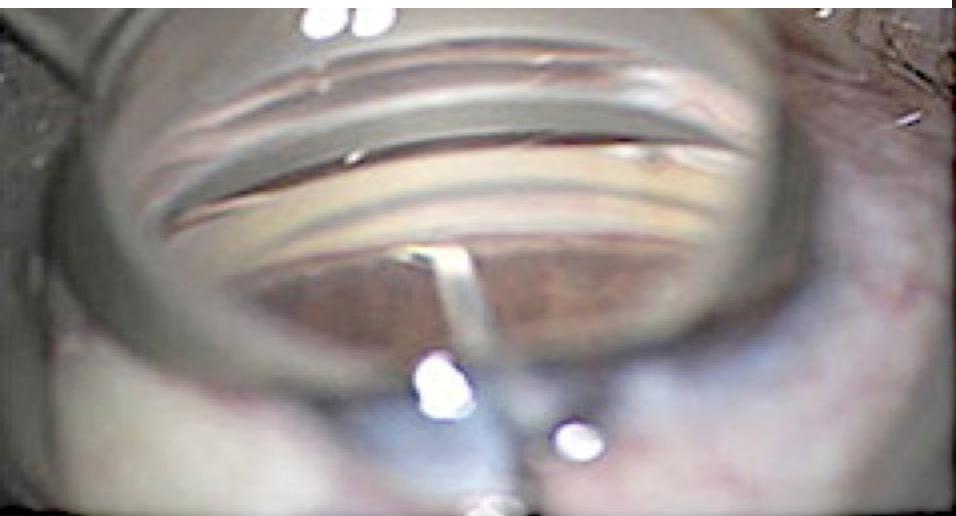
MANAGEMENT

- **NO ROLE FOR MEDICAL TREATMENT.**
- Surgery should be done as early as possible.
- Treatment is by goniotomy if the cornea is clear and by trabeculotomy if the cornea is scarred

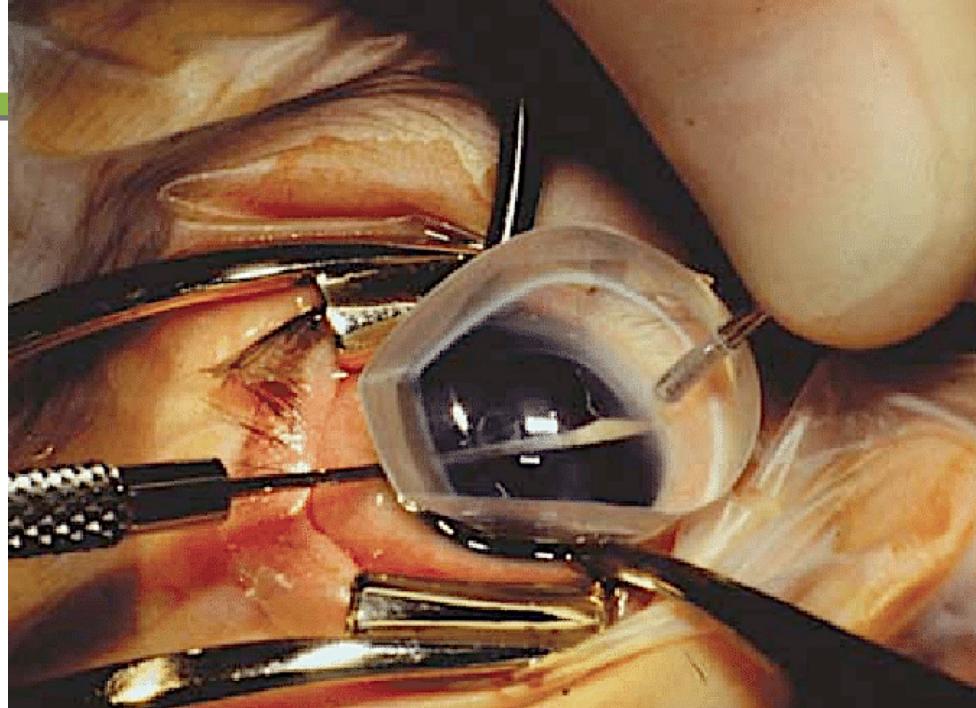


GONIOTOMY

If the cornea is
clear.



Intraoperative view of eye's drainage system as a goniotomy is being performed.

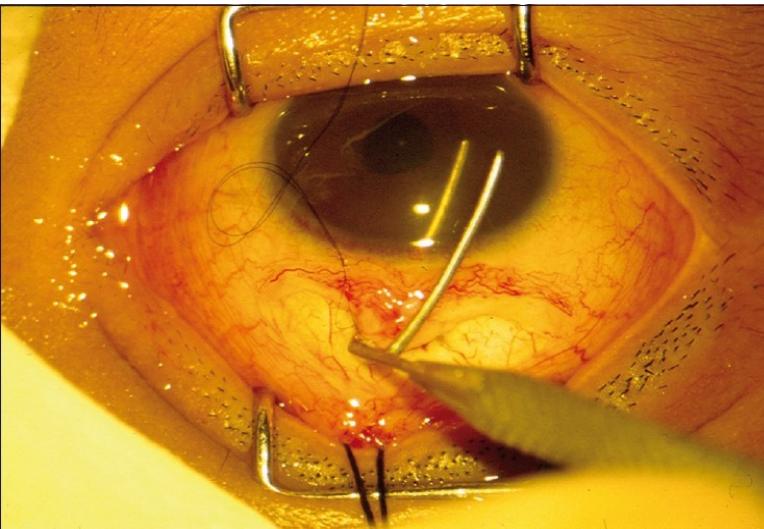
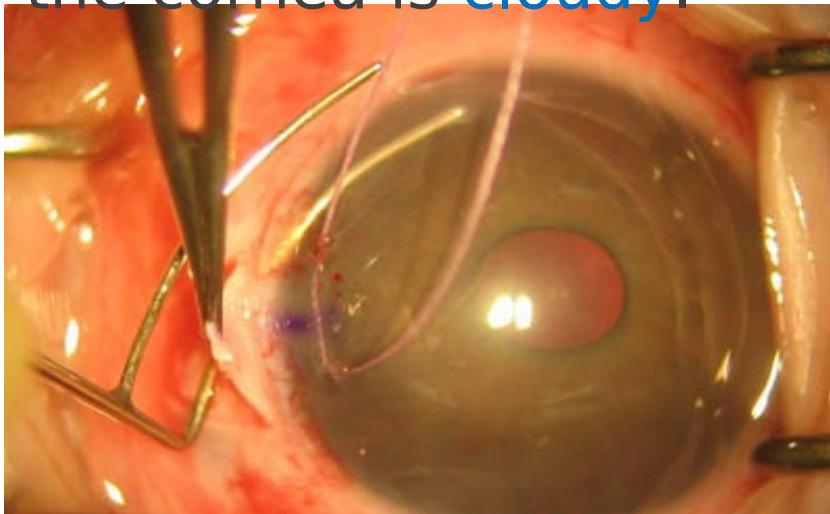


Goniotomy- removal of the surface layer of the drain.



TRABECULOTOMY

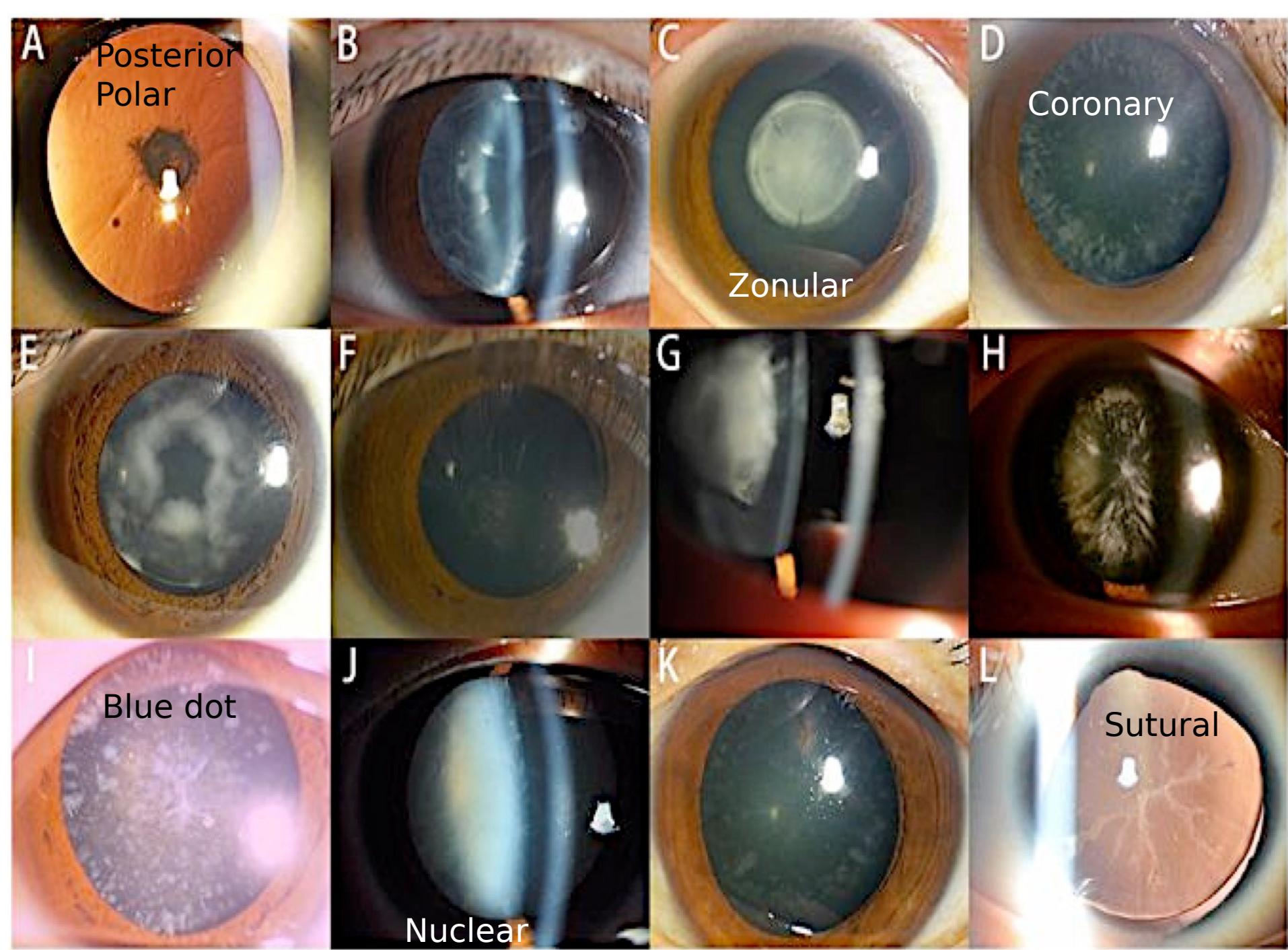
If the cornea is **cloudy**.



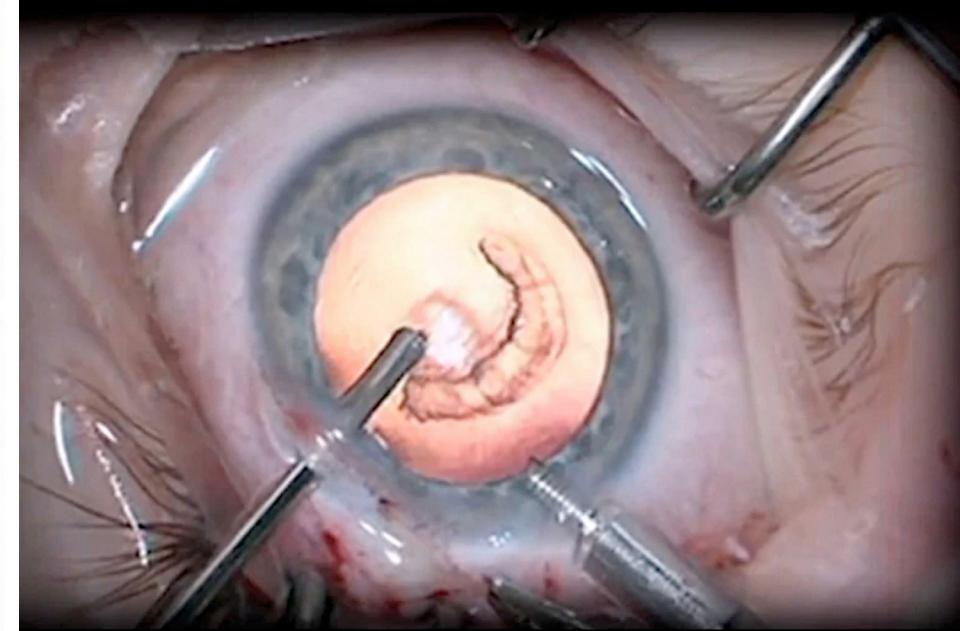
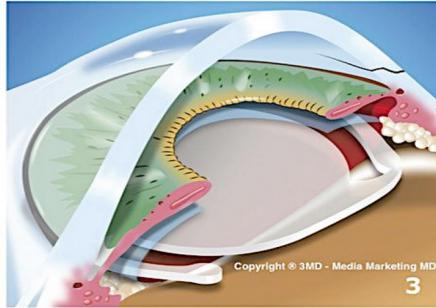
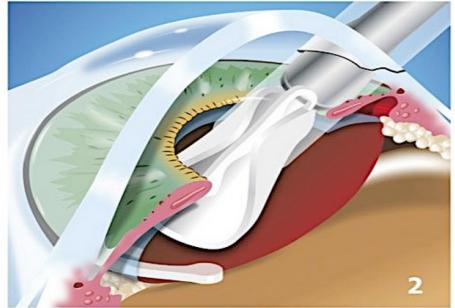
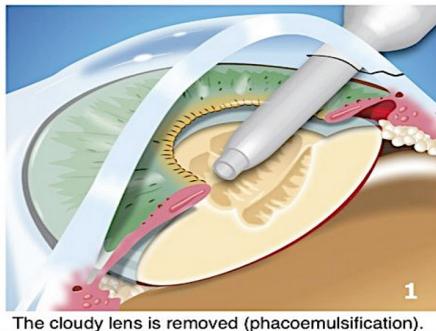
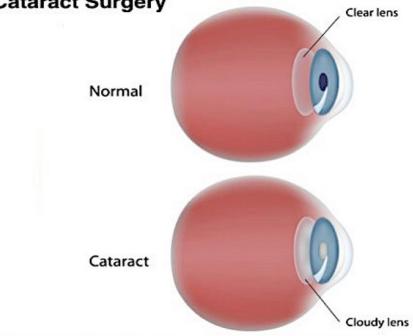
Trabeculotome

DEVELOPMENTAL CATARACT

- Congenital cataract is present at birth, while developmental cataract starts in childhood
- There are many varieties with variable effect on vision
- **Unilateral** cataract can result in **squint** and **amblyopia**
- **Bilateral dense** cataract can cause sensory **nystagmus**
- If cataract affects vision it is removed by **lensectomy** and an IOL is implanted
- Unilateral and bilateral dense cataracts must be **removed early in life** (around 6 weeks)

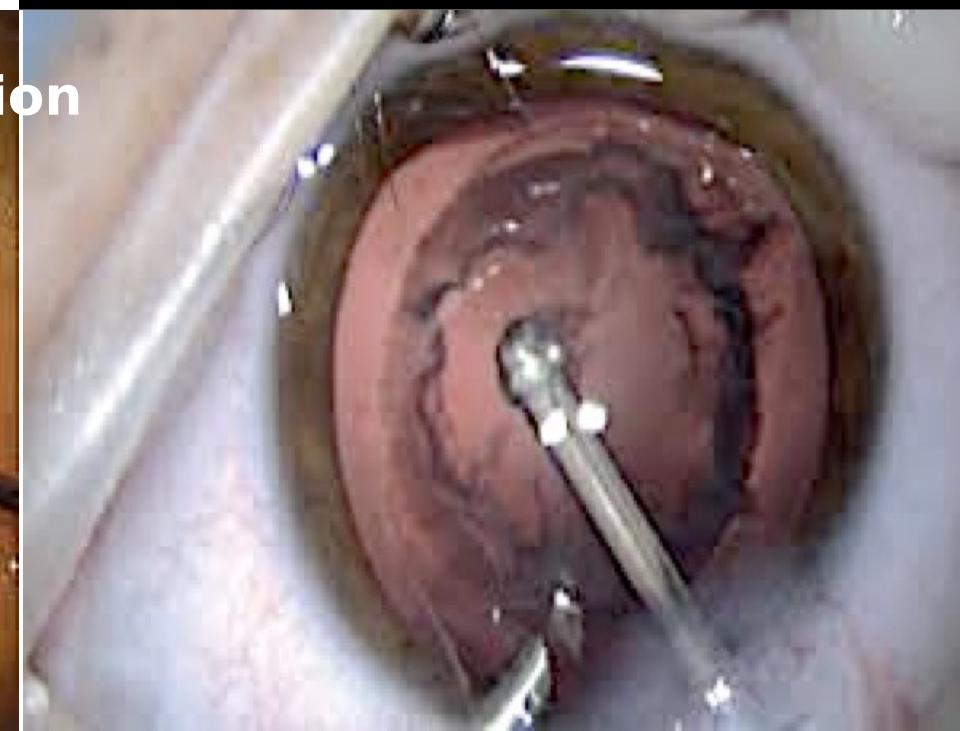


Cataract Surgery



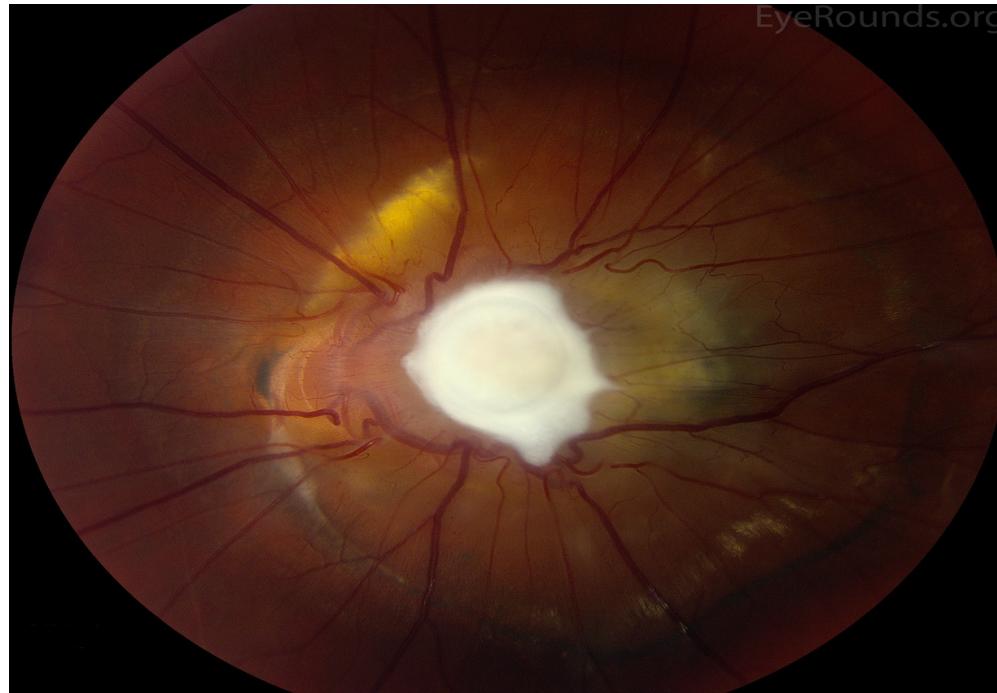
A clear artificial lens is implanted into the empty capsule of the lens.

Intraocular lens (IOL) in place.

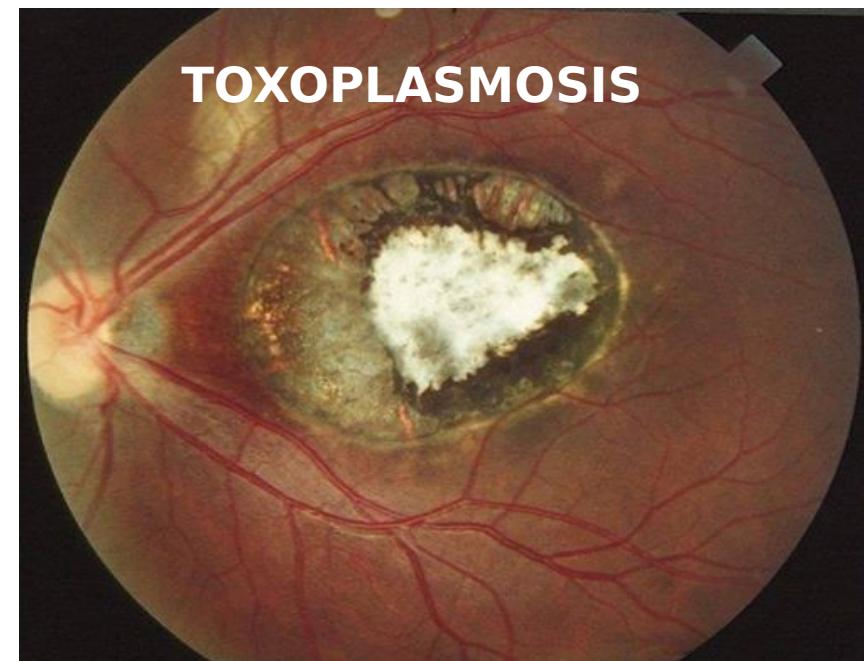


LEUKOCORIA

- Retinoblastoma (most serious)
- Congenital cataract (most common)
- Retinopathy of prematurity
- Toxocariasis



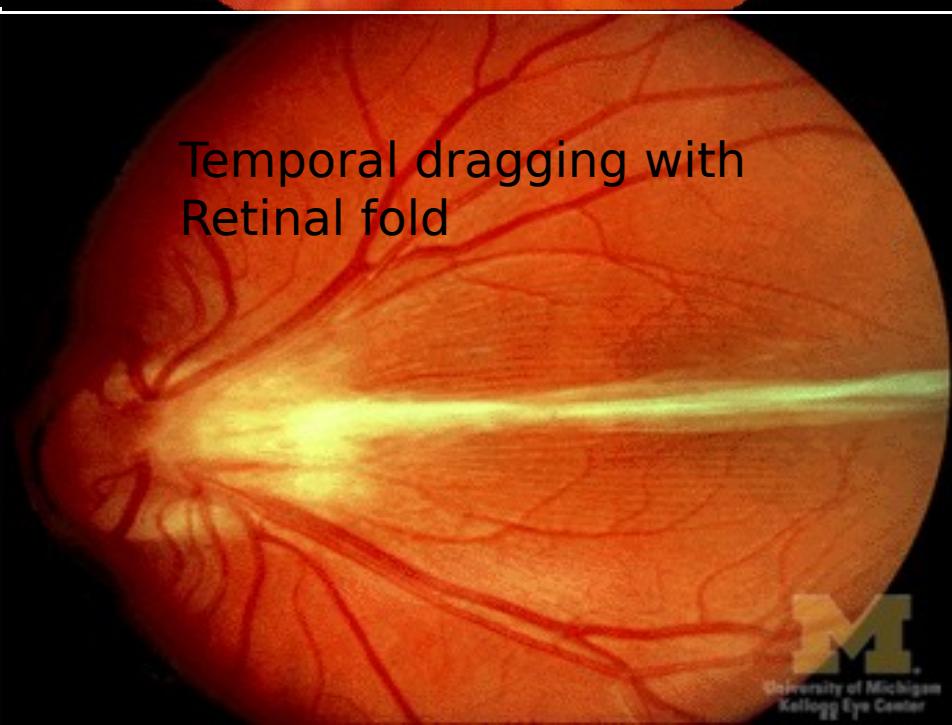
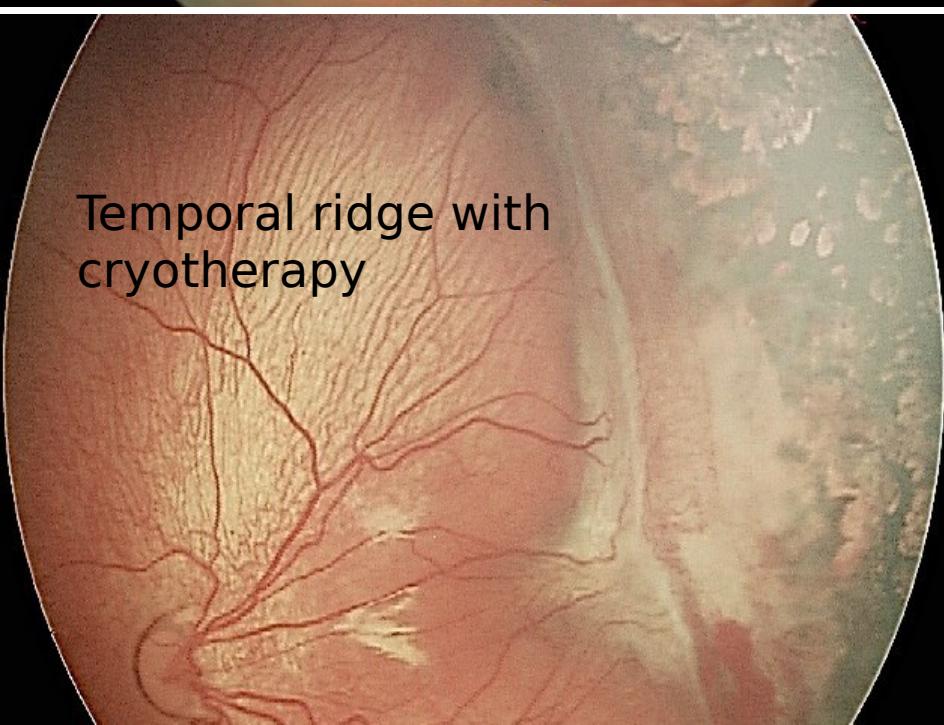
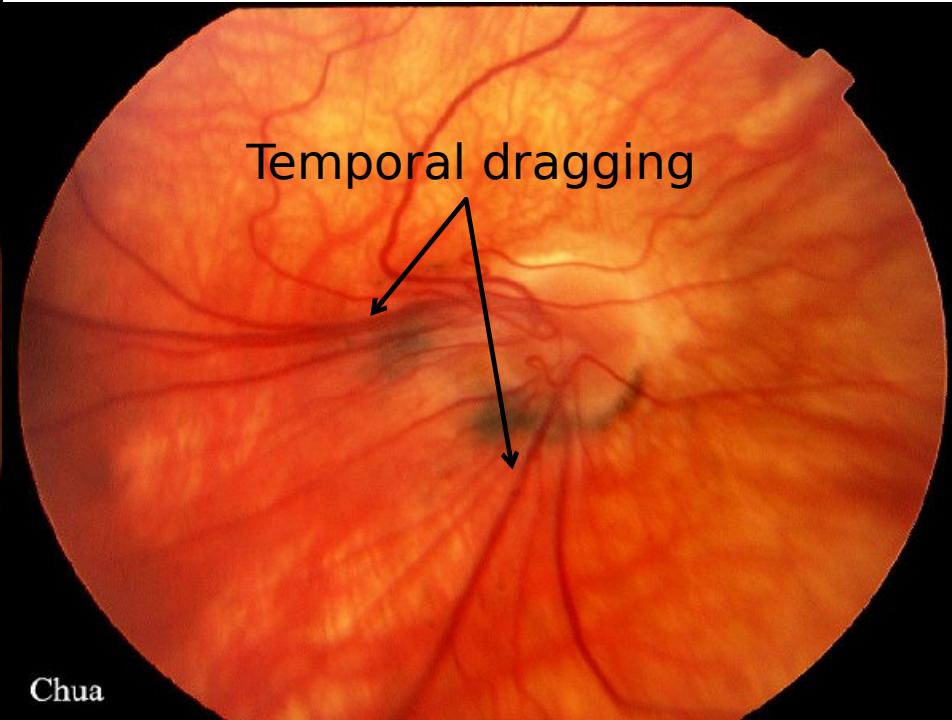
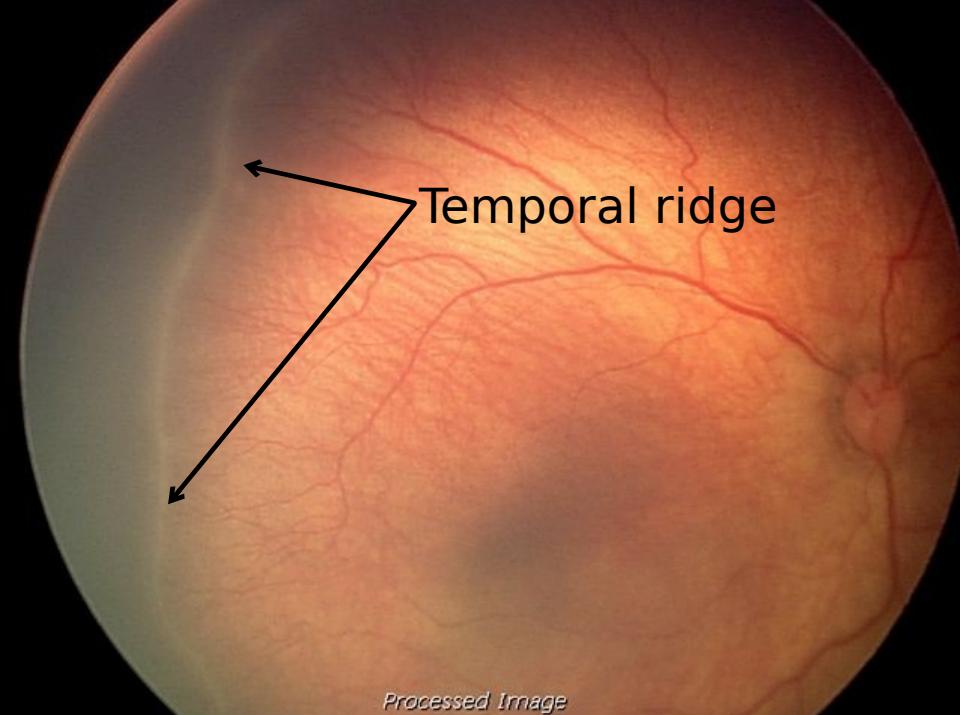
TOXOCARIASIS
S



TOXOPLASMOSIS

RETINOPATHY OF PREMATURITY

- A retinopathy that affects premature babies (<31 weeks) placed in incubators with 100% O₂ therapy
- Prematures have retinal arteries that do not reach the temporal retinal periphery, with high dissolved O₂ the vessels stop to grow
- When removed from O₂ the peripheral retina becomes ischemic and produces **VEGF** which causes new vessels, fibrosis and tractional RD
- Treatment is by
 - Early detection by **screening of prematures**
 - Injection of **anti-VEGF**
 - Laser/Cryo treatment to ischemic retina
 - **Vitrectomy for tractional RD**



RETINOBLASTOMA

- A malignant tumor of the retina that appears mostly in the first 3 yrs. of life
- There are 2 types
 - Sporadic: single tumor, more common, better prognosis
 - Genetic; autosomal dominant, multiple and bilateral, secondary non-ocular cancers
- The most common presentation is leuokoria, less common presentations are
 - Strabismus
 - Buphtalmos
 - Masquerade syndrome (uveitis-like)
 - Proptosis

The tumor tends to spread along the optic nerve to the brain

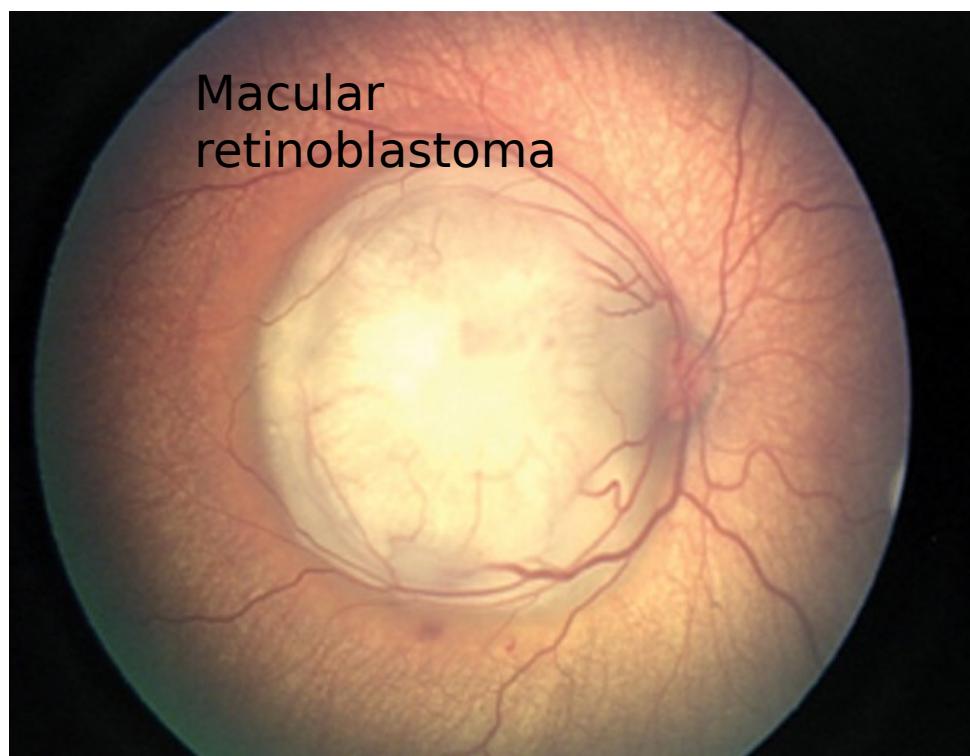
Bilateral retinoblastoma



Left retinoblastoma

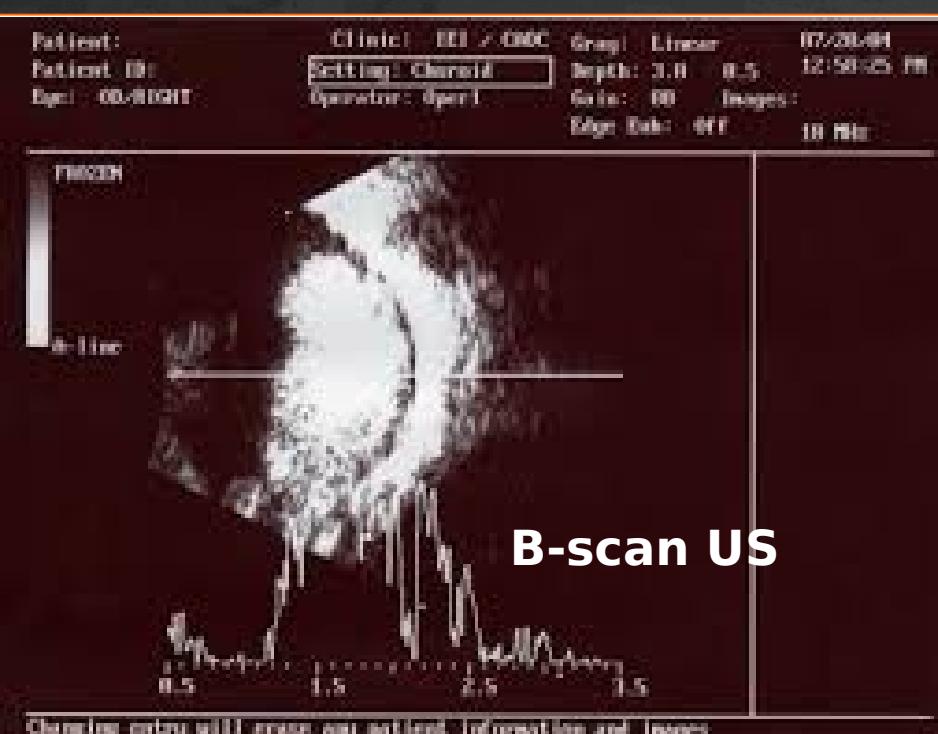
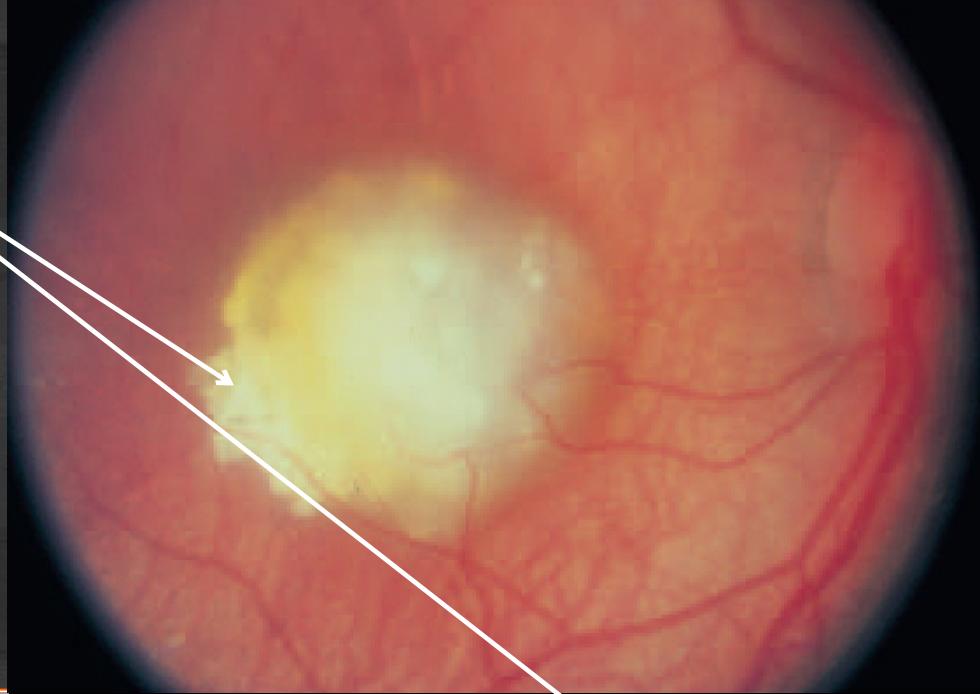
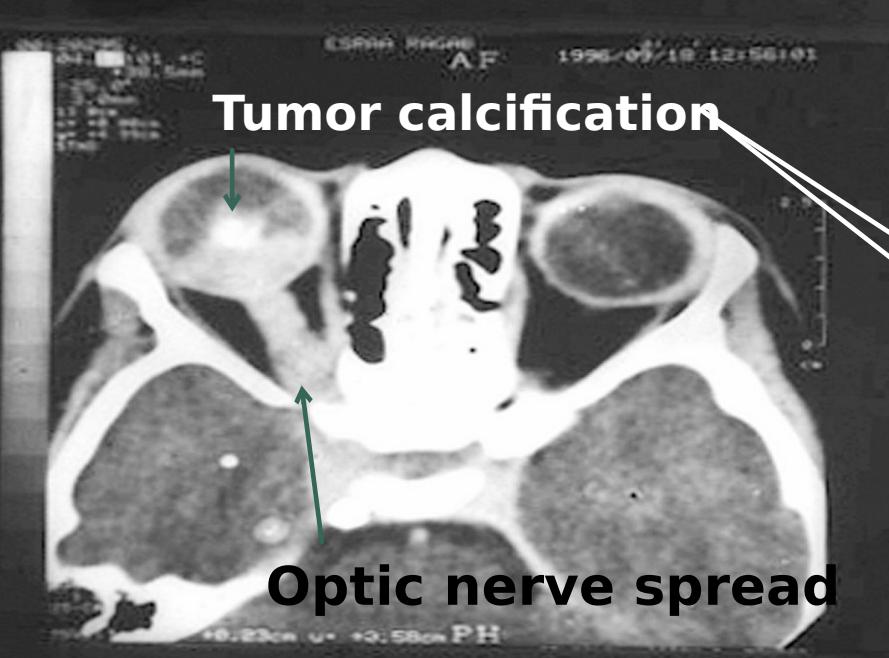


Macular
retinoblastoma



DIAGNOSIS

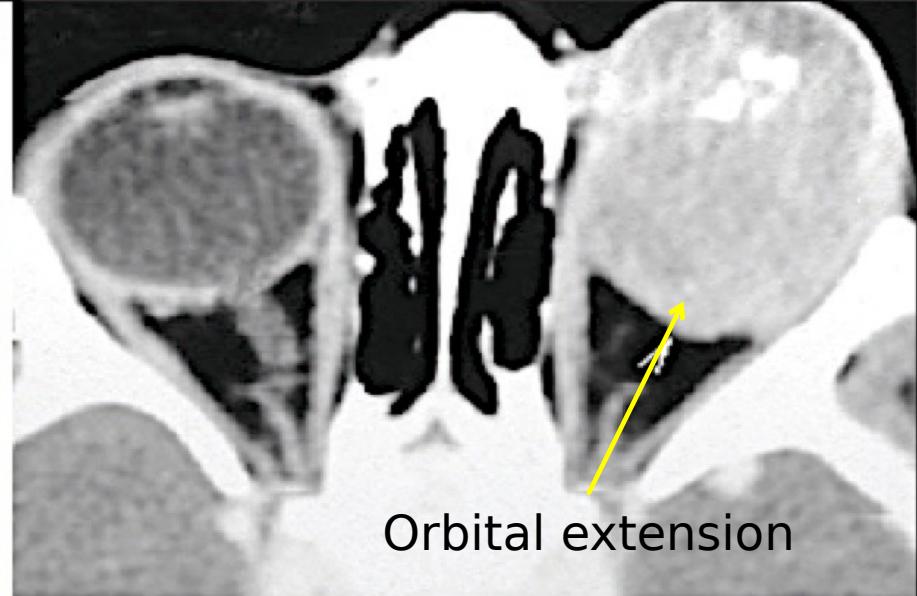
- Examination under anesthesia (**indirect** ophthalmoscopy)
- Examination of siblings
- **B-scan:** tumor size
- **CT and MRI:** spread along optic nerve and into orbit



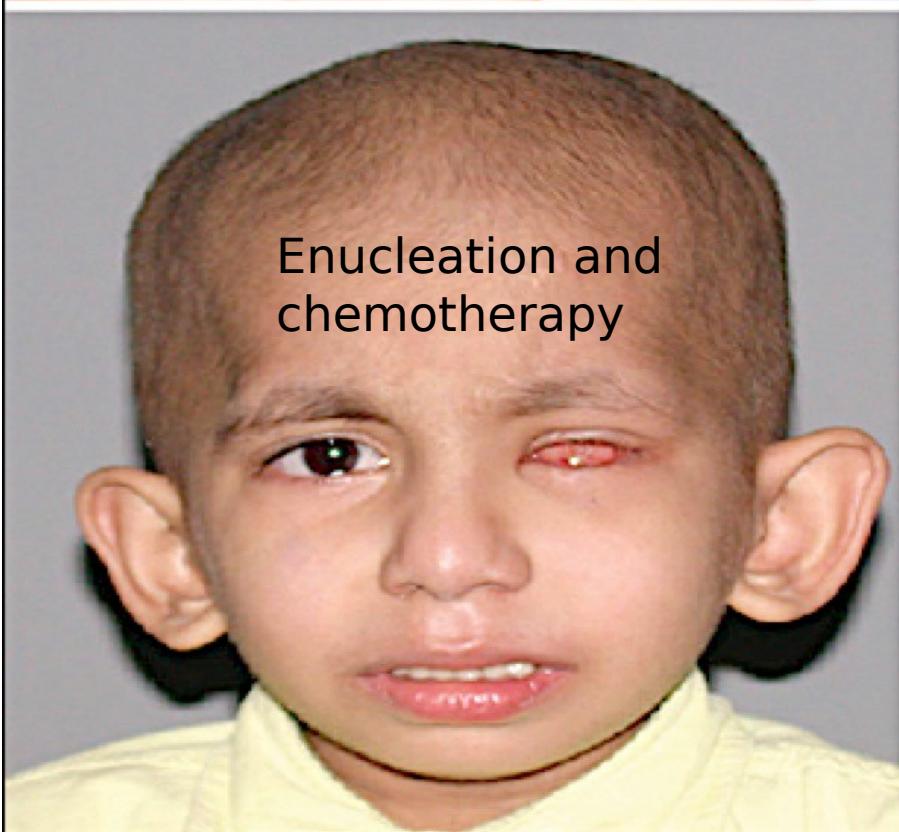
TREATMENT

- Large unilateral tumors are treated by **enucleation**
- Bilateral cases and small tumors are treated by **chemotherapy** (intra-carotid melphalan), and **radioactive plaques**.
- Survivors may suffer from secondary malignancies as **osteosarcoma**

Advanced retinoblastoma
With orbital involvement



Enucleation and
chemotherapy

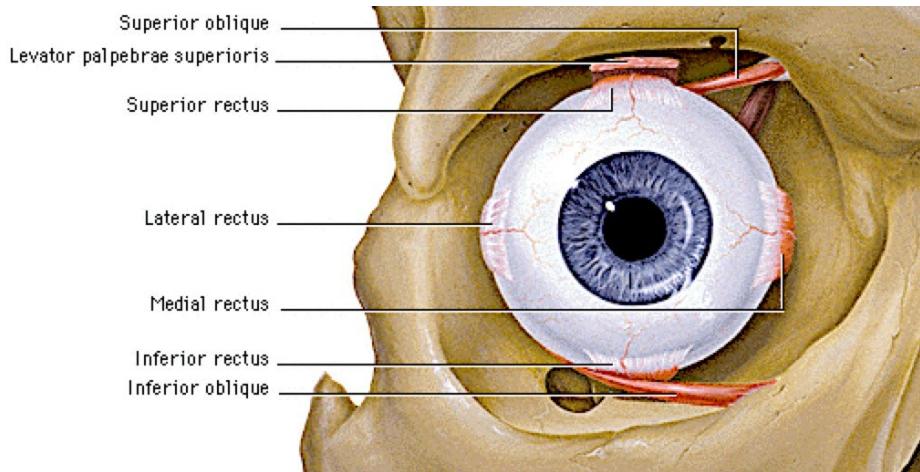
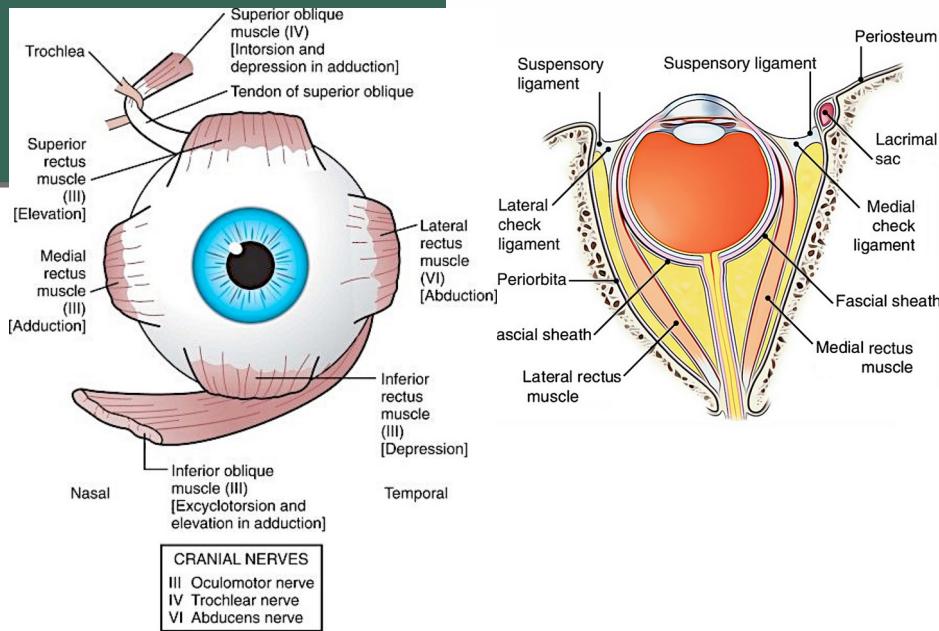


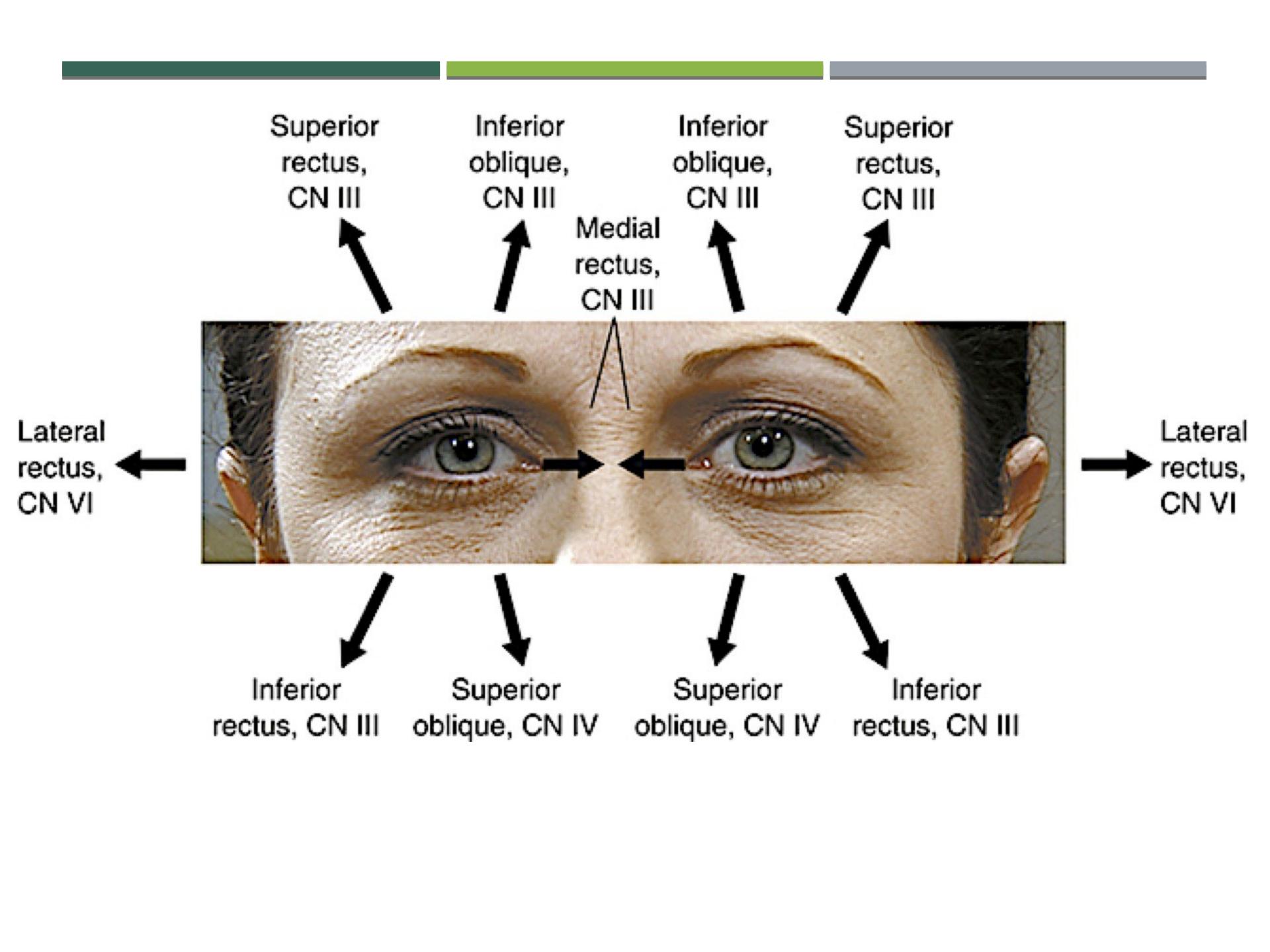


STRABISMUS (SQUINT)

EXTRAOCULAR MUSCLES

- The eye is moved by 4 recti and 2 oblique muscles
- All muscles are supplied by CN3 except the lateral rectus (CN6) and the superior oblique (CN4)



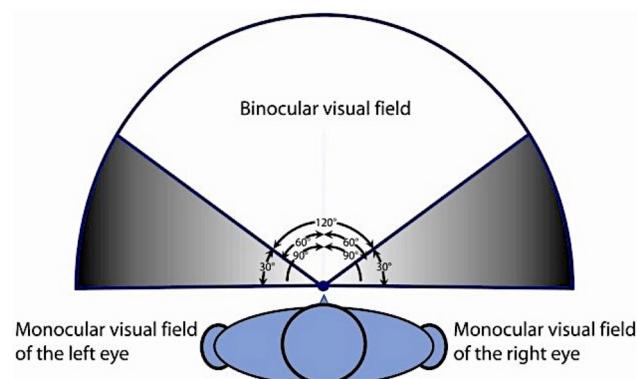
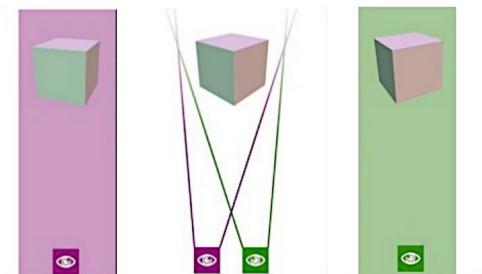


BINOCULAR SINGLE VISION (BSV)

- It is the fusion of both eyes' images into a single image
- The main drive for binocular fusion are the advantages of binocular single vision as
 - Wider field of vision
 - Depth perception
 - Accurate distance estimation
 - Stereopsis

III. STEREOPSIS (Gk: Stepeos = solid, opsis = look)

Ability to obtain an impression of depth by the superimposition of two pictures of the same object taken from slightly different angles



BSV DEVELOPMEN T

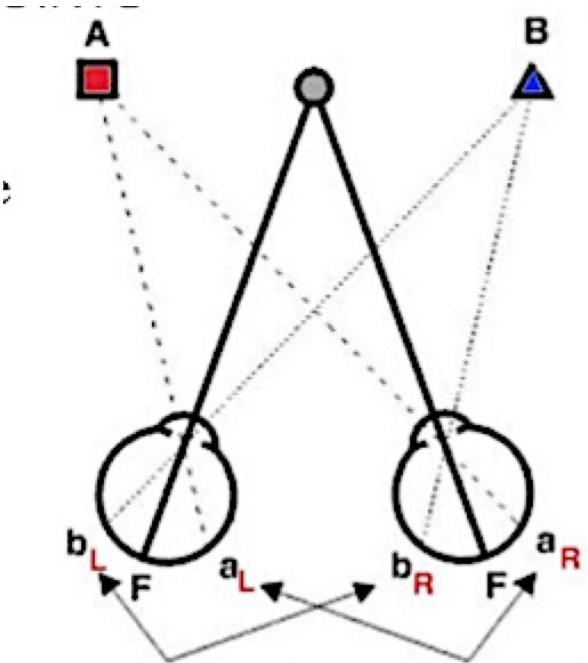
Starts by 4-6 months of age and continues to develop until 5-7 years

Any interference with the development in the critical years could result in

squint/amblyopia
It cannot be developed **de novo after 6 years**

Once firmly established it rarely breaks even with prolonged drop of vision in one eye

CORRESPONDING RETINAL POINTS



a_L and a_R are corresponding points
b_L and b_R are corresponding points

- As BSV develops a **retinal map** is created by the visual cortex
- This map assigns the **fixation value** to the foveas of the 2 eyes
- Then each point temporal to one fovea is coupled to a corresponding nasal point in the other eye; this is the concept of **CORRESPONDING RETINAL POINTS**
- This correspondence prevents any diplopia and improves depth perception
- If it is violated, binocular **diplopia results**

SENSORY CHANGES IN STRABISMUS

■ Suppression is a **sensory adaptation** that occurs in long standing strabismus



AMBLYOPIA

- Defined as the reduction of best-corrected visual acuity that cannot be attributed to a structural abnormality of the eye.
- It affects 3-5% of children
- It develops from the interruption of BSV at any age between birth and 6-years of age resulting in the interruption of normal cortical visual pathway development.
- Causes of this interruption could be
 1. **Anisometropic amblyopia:** error difference of 2 diopters or more
 2. **Strabismic amblyopia:** in the squinting eye
 3. **Sensory-deprivation amblyopia:** cataract, corneal opacity, retinal detachment...etc in childhood

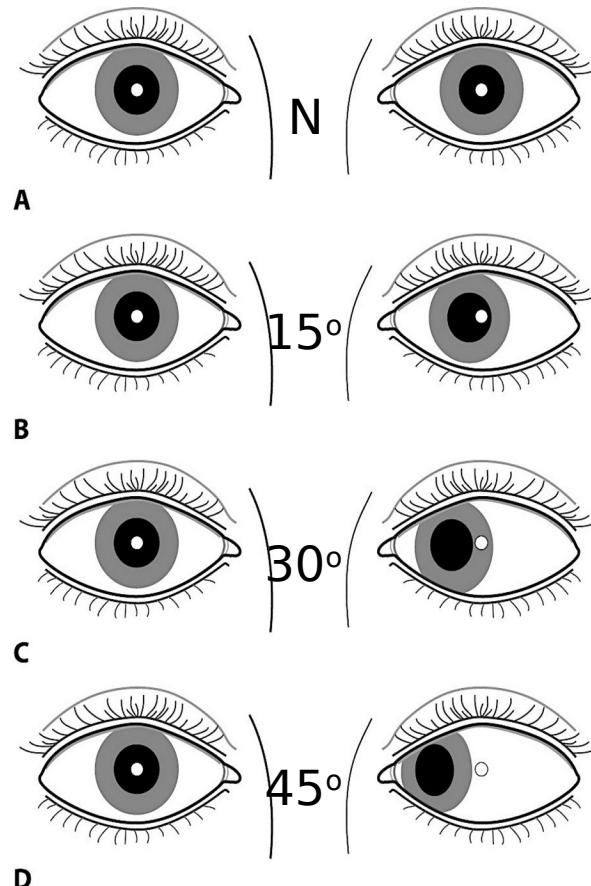
TREATMENT

1. Correction of any problem in the amblyopic eye (MUST)
2. Occlusion of the better eye 2-12 hours/day



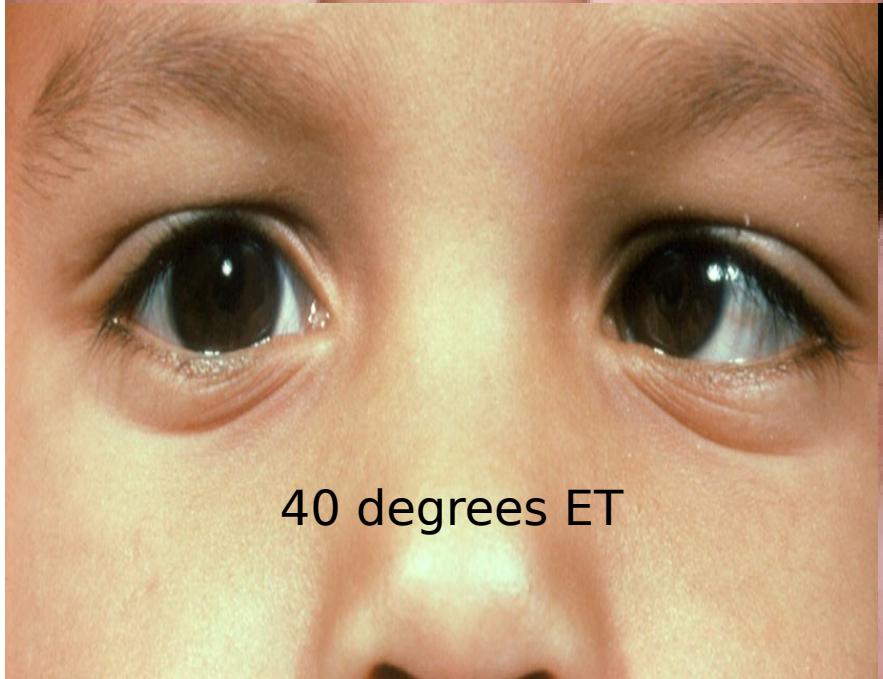
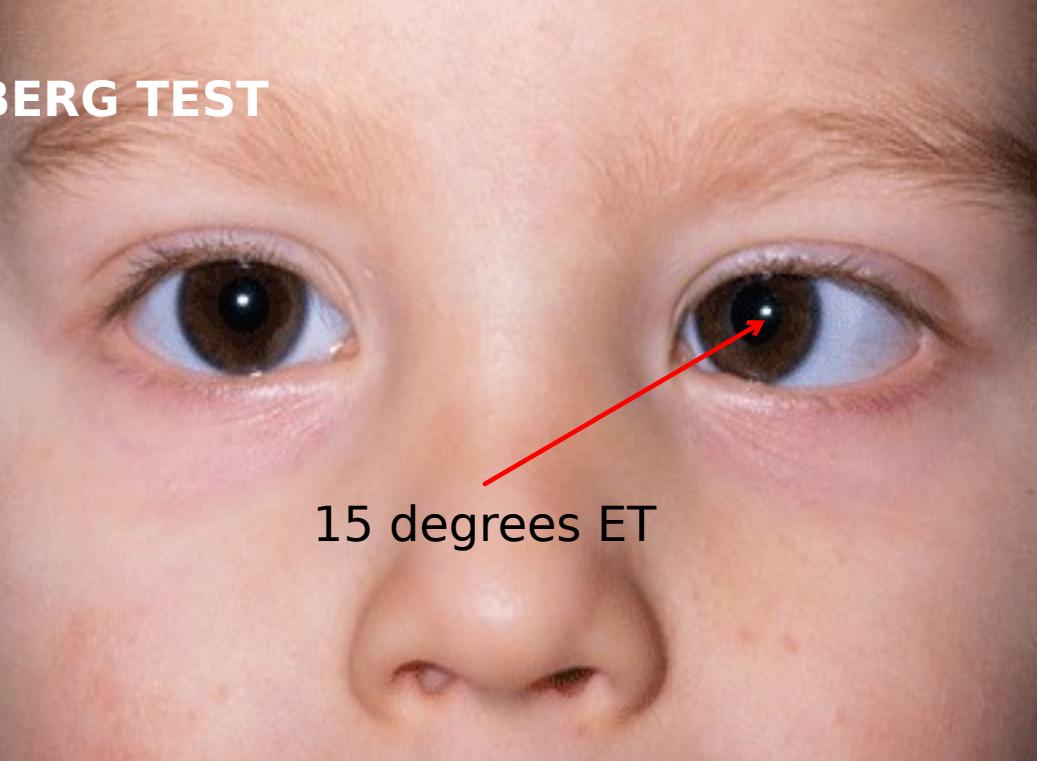
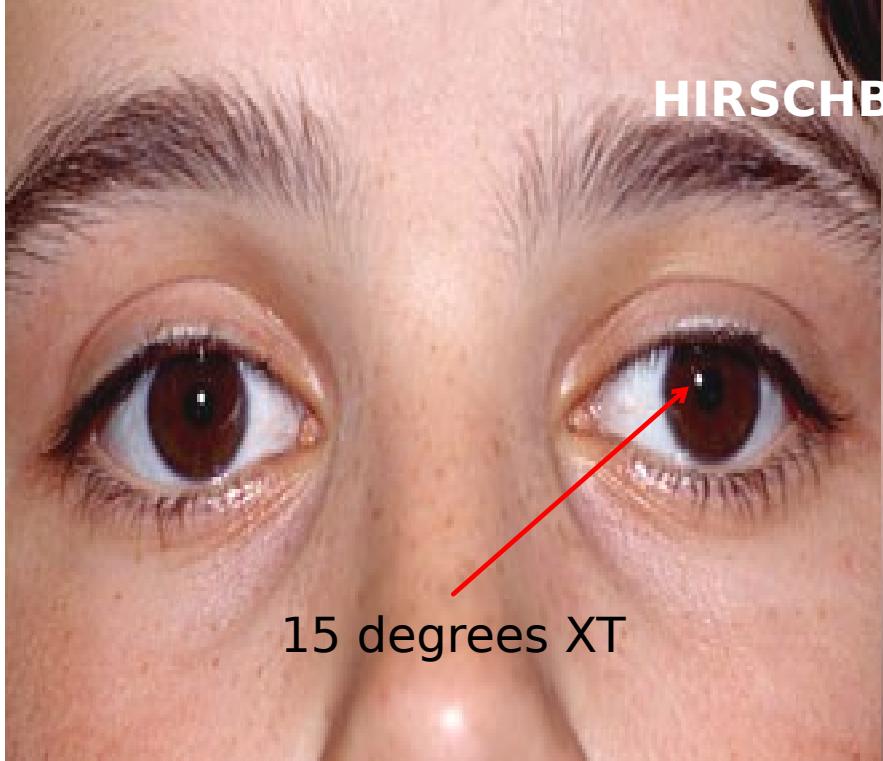
EXAMINATION TECHNIQUES FOR OCULAR ALIGNMENT: HIRSCHBERG TEST

- The test uses the **corneal reflex** (1st Purkinje image) to assess the presence of squint and measure its angle
- Normally the reflex is in **the same position** in both eyes
- When the reflex is at the
 - Edge of pupil \square 15° of squint
 - Mid-iris \square 30°
 - Limbus \square 45°



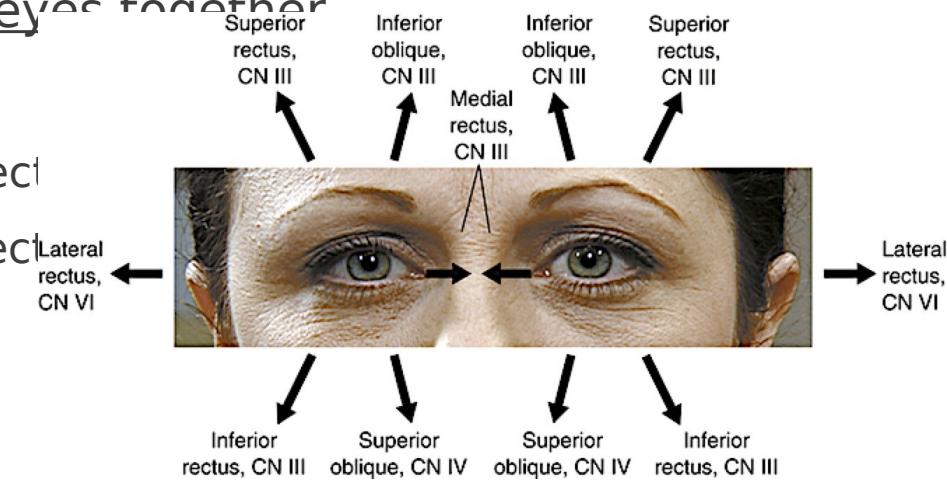
Hirschberg test

HIRSCHBERG TEST



OCULAR MOTILITY TESTING

- Ductions are tested in **the 6 cardinal directions** for each eye separately
- Versions are tested for both eyes together
- If the eye movement is limited
 - Laterally (abduction) □ lateral rectus
 - Medially (adduction) □ medial rectus
 - Up and out □ superior rectus
 - Up and in □ inferior oblique
 - Down and out □ inferior rectus
 - Down and in □ superior oblique



EXAMINATION TECHNIQUES: COVER TEST

- An essential step in squint evaluation
- **THE FIXING EYE IS COVERED** the squinting eye moves to fix the light
- **No movement= no squint**

HETEROTROPIAS

In esotropia, one eye is deviated toward the other. Note that the corneal light reflex is not centrally placed.



Cover the esotropic eye—there is no movement of either eye.



The cover is then removed—again, there is no movement of either eye—no proof of tropia.



The other eye is now covered—as a result, that eye becomes esotropic and the formerly esotropic eye moves to a central position to take up fixation.



If the cover is removed and no eye movement occurs, this indicates that the eyes have equal visual acuity or fixation. This also indicates a relative absence of amblyopia.



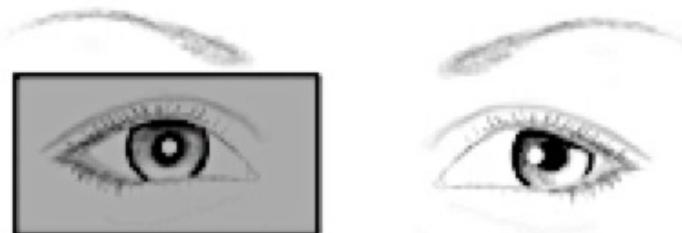
If the cover is removed and both eyes move so that the original fixing eye is again centrally fixed and the originally esotropic eye is again esotropic, this indicates that there is amblyopia present. In this case, the patient's left eye is amblyopic.



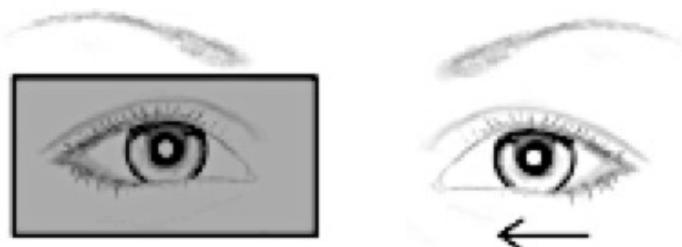
The same maneuvers can be used to determine the presence of exotropia (outward deviation), hyper- and hypotropia (upward and downward deviation), and cyclotropia (rotary displacement).



A. Left exotropia



B. The right eye is covered

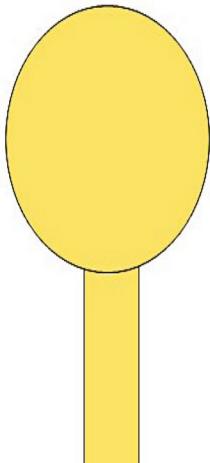
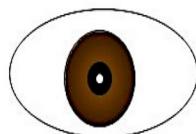
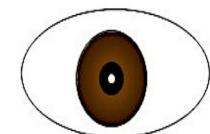


C. The abnormal left eye is observed for corrective movement as it takes up fixation

Figure 3. The cover test

EXAMINATION TECHNIQUES: COVER-UNCOVER TEST

- Is used to diagnose heterophorias
- There should be no squint
- One eye is covered (cover) and then the cover is removed (uncover)
- If the eye deviates under the cover (phoria), it will make a corrective movement when the cover is removed



Cover – Uncover test

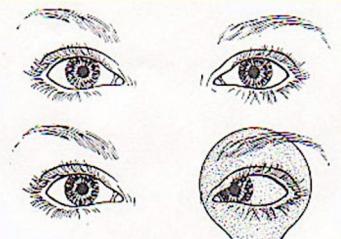
Orthophoria, normal

No complaints, asymptomatic



Cover-Uncover Test

- Used to detect latent strabismus
- Child fixes on object (near or far)
- A cover is placed over one eye for a few seconds then rapidly removed
- The eye under the cover is observed for movement



COVER-UNCOVER TEST



A. Alignment appears normal



B. The abnormal left eye drifts into a deviated position when covered (In this case, a latent left exophoria)



C. The cover is removed and the newly uncovered eye is closely observed for corrective movement

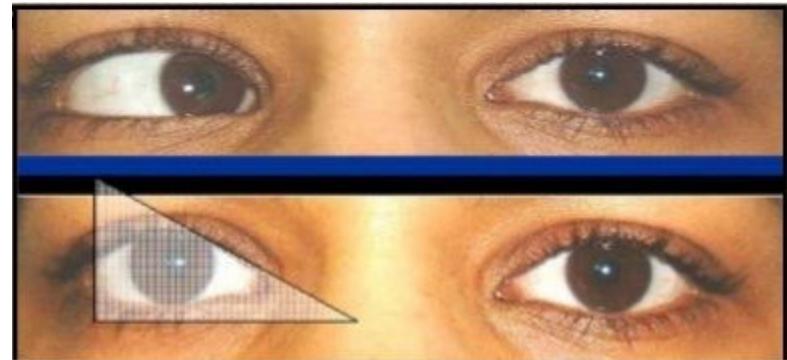
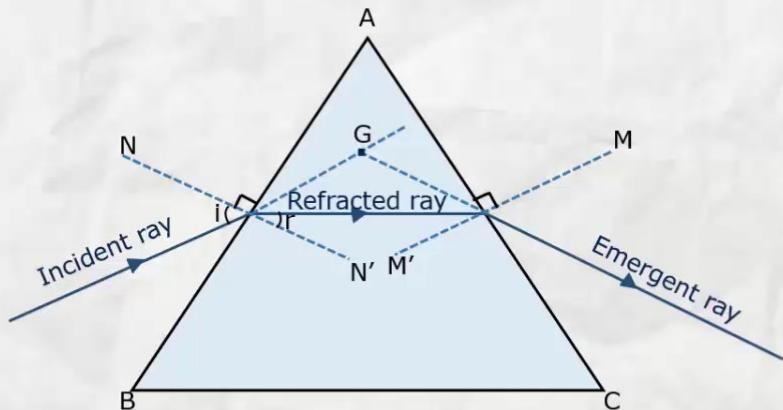


D. The abnormal eye resumes normal alignment

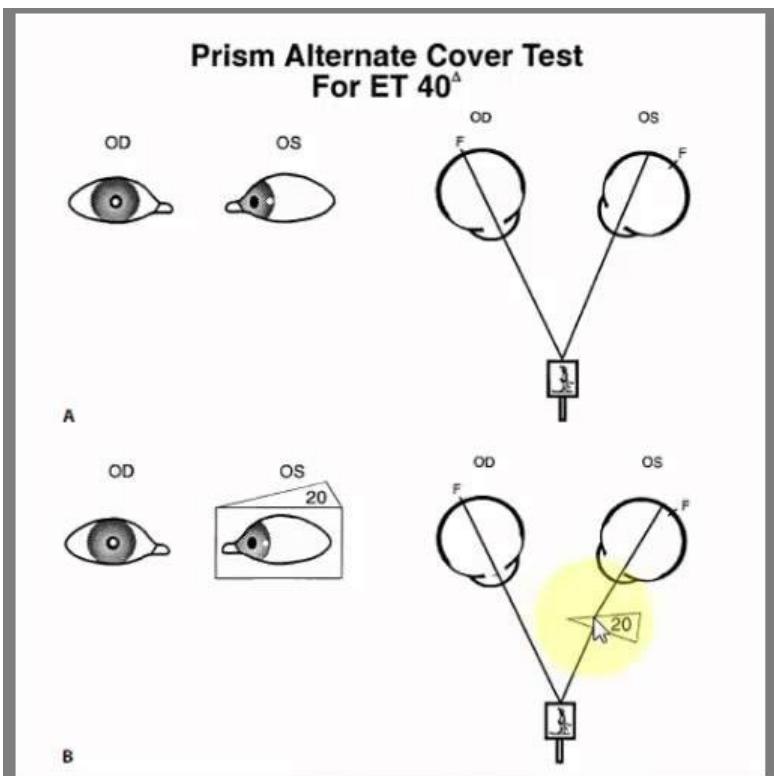
EXAMINATION TECHNIQUES: PRISM AND COVER TEST

- Is used to accurately measure the angle of squint in **prism diopters**
- The fixing eye is covered as usual and a prism is placed in front of the squinting eye and increased in steps until it no longer moves when the fixing eye is covered
- This will be the **accurate** angle of squint

Refraction of Light Through a Prism



**Prism Alternate Cover Test
For ET 40°**



Prism Cover Testing

- Measures angle of deviation
- Prism over deviating eye
- Prism orientation:
 - $ET = BO$, $XT = BI$
- Adjusted until no movement
- Performed at near and distance and in different gaze positions
- Tables and experience used to calculate amount of surgery for deviation measured



APPARENT SQUINT

PSEUDO STRABISMUS

- Clinical **impression** of ocular deviation, when **no** squint is present

HIRSCHBERG TEST

EPICANTHUS

PSEUDO ESOTROPIA



HYPERTELORISM

PSEUDO EXOTROPIA



Tropia (manifest squint)

- Horizontal
 - Esotropia
 - Exotropia
- Vertical
 - Hypotropia
 - Hypertropia

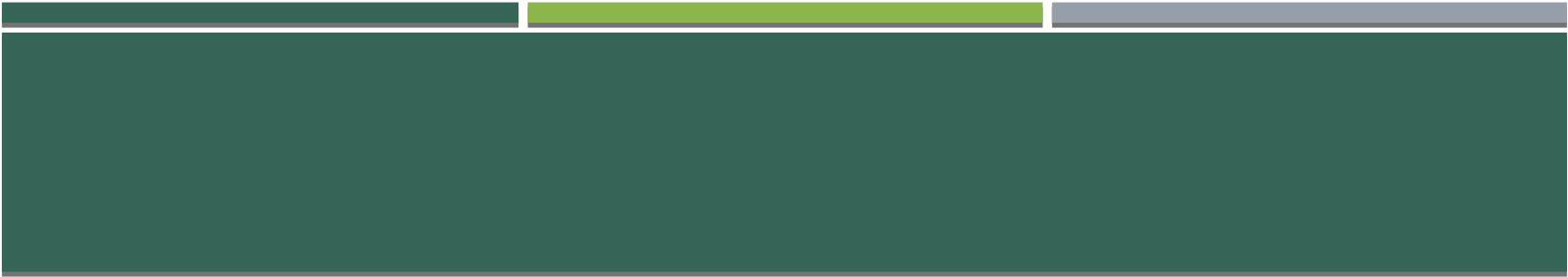
Phoria (latent squint)

ESOTROPIA: TYPES

- **Accommodative ET**
- **Non-accommodative ET**
- **Paralytic ET:** CN6 palsy
- **Mechanical or restrictive ET:** dysthyroid eye disease

- A 3-year-old presents with right eye deviation since 3 months.
- Visual assessment shows 6/36 vision OD, 6/6 vision OS
- Eye examination including fundus is free
 - What NEXT?

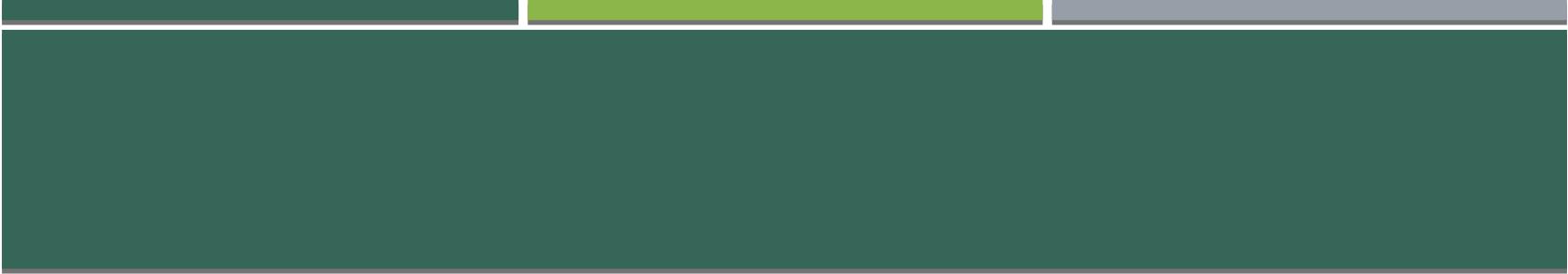
- **HIRSCHBERG** test: Reveals 30° Rt ET with constant fixing by the Lt eye
- **COVER** test: when left eye is covered right eye picks fixation but re-deviates once cover is removed
- **MOTILITY** test: is free in all directions
- Atropine refraction reveals +5.0 D and +3.5 D in OD and OS resp.
- With proper refraction **OD** improves to 6/18



■ What next?

- **Prescription** of glasses; +4.5 D right eye and +3.0 D left eye
- Re-examination reveals that angle of squint is corrected but vision in right eye is still 6/18
 - What next? ooooooooooooooooooo

- **Complete occlusion** of the left eye for 3 weeks
- Re-examination after 3 weeks shows that right eye vision improved to 6/6
 - What next?



■ Occlusion of the left eye for 2-6hrs/day for several months

ET: ACCOMMODATIVE



- Develops at the age of 2-4 years
- The main drive is **hypermetropia**
- Hypermetropia causes **excess accommodative convergence** effort that could lead to ET
- Commonly unilateral
- Amblyopia common
- Corrected by **glasses**

- The **manifest** hypermetropia should be **fully** corrected
- Total hypermetropia is revealed by **atropine** ointment 1%, 3 times daily for 3 days بقلل cilairy cont.
- If the eyeglasses only partially correct the angle of squint is called “**partially accommodative**” and if no correction occurs, it is termed “**non accommodative**”
- The non-corrected part by glasses is corrected by **surgery**

**AC ET is BEST corrected with
GLASSES**



ET: PARALYTIC

- It occurs due to **CN6 palsy** causing LR palsy
- **Horizontal binocular diplopia is common, nausea.**
- The **degree** of ET and the **angle** of squint are **variable** in different directions---they **increase** in the **direction of the palsied muscle** (looking to the left in LLR palsy and looking to the right in RLR palsy)
- There is **face turn toward the palsied muscle** to decrease diplopia
- Common causes of CN6 palsy include
 - Children: head trauma, viral infections
 - Adults: diabetic/atherosclerotic nerve infarction, head trauma, increased ICT (tumors etc.)
- Treatment:
 - **MRI if papilledema is present**
 - Observation for 3-6 months for signs of recovery
 - **Surgery**



PARALYTIC ET



■ Restrictive (mechanical) ET

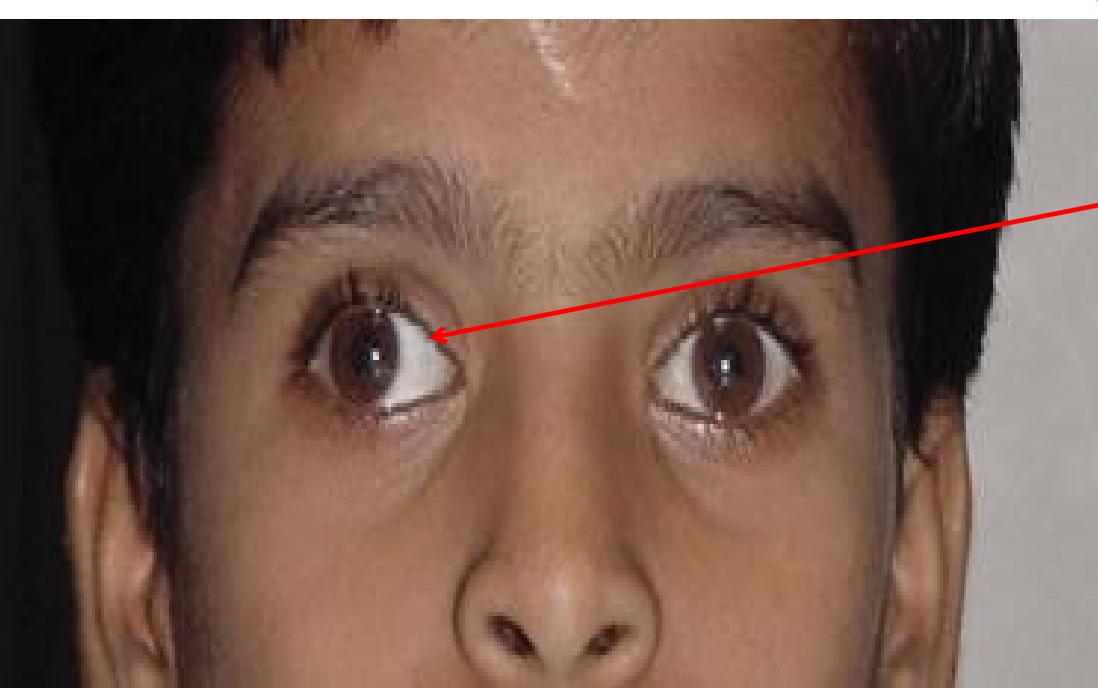
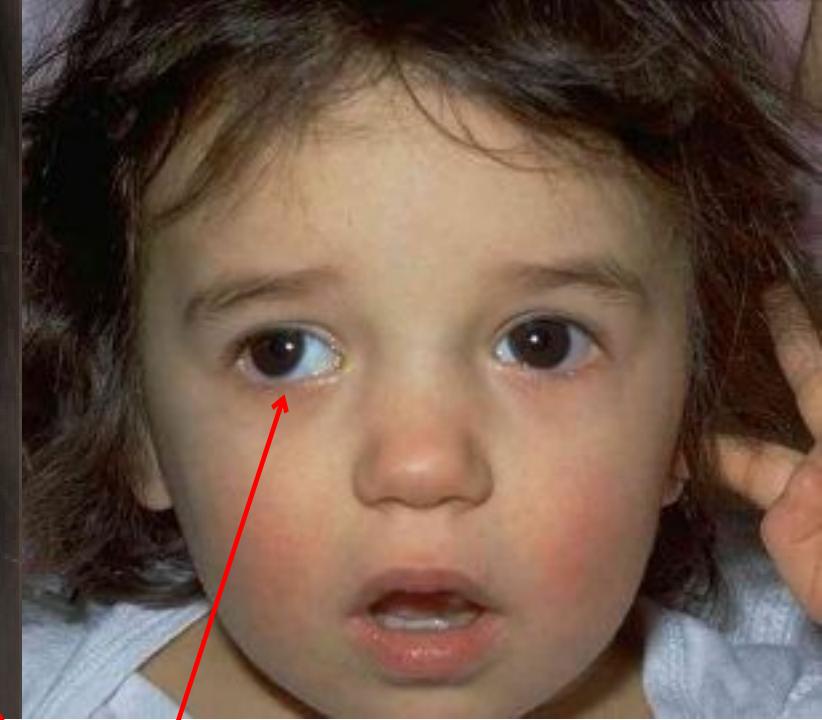


EXOTROPIA: TYPES

- **Intermittent/Constant**
- **Myasthenic:** variable, more by evening +/- ptosis نهاية اليوم
- **Paralytic:** **no** isolated medial rectus palsy; **INO:** defective adduction in MS (lesion of MLF)
- **Restrictive:** dysthyroid eye disease; ET more common

INTERMITTENT XT:

- Affects children around 4-6 years of age
- Not related to myopia
- Deviation occurs for sometime during the day esp. with fatigue or emotions but orthotropic through most of the day
- Must be differentiated from myasthenia
- **Surgery** only if **cosmetically** disturbing or present **half of the day**

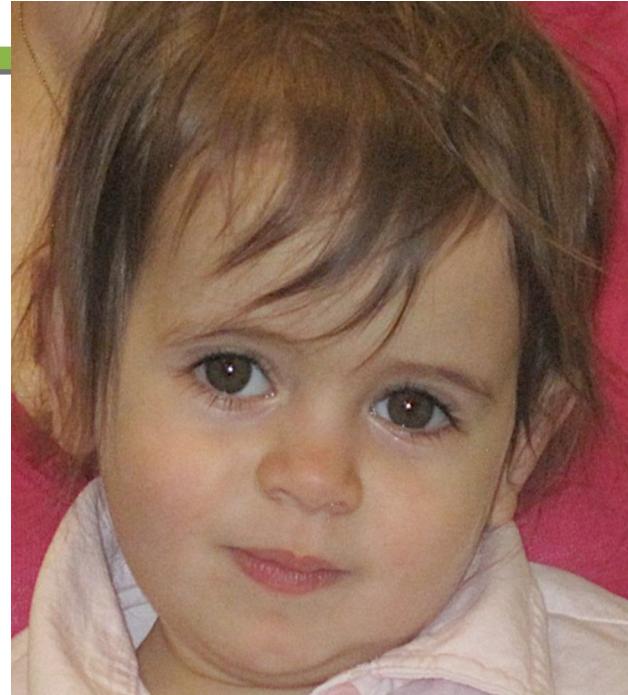


**Intermittent XT during
the dissociation**

VERTICAL TROPIA

- Hypertropia or hypotropia
- Common causes are
 - **CN4 palsy:** under-depression of the adducted eye
 - **Thyroid Eye Disease**
 - **Orbital floor fracture:** restricted elevation
- Vertical binocular diplopia common
- Treatment is commonly **surgical** with aim to relieve diplopia in primary position

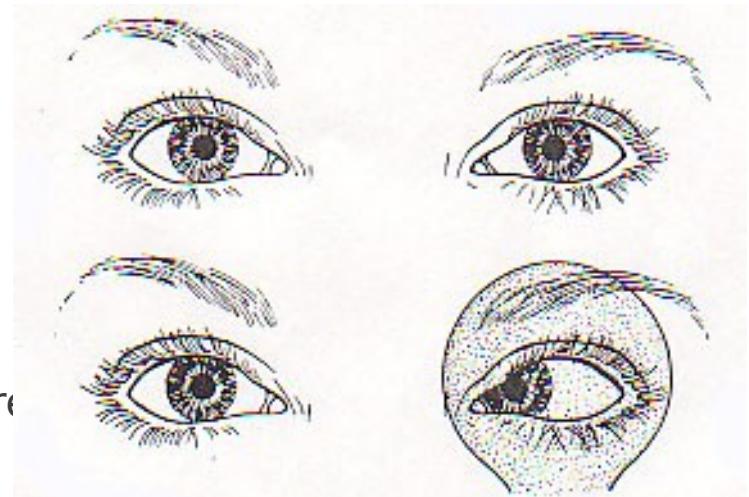
**Head tilt in CN4
palsy**



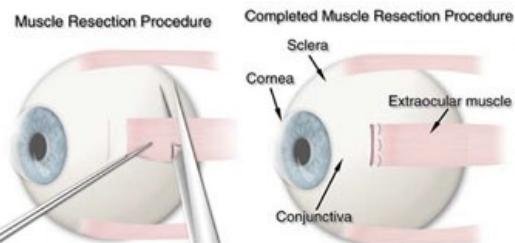
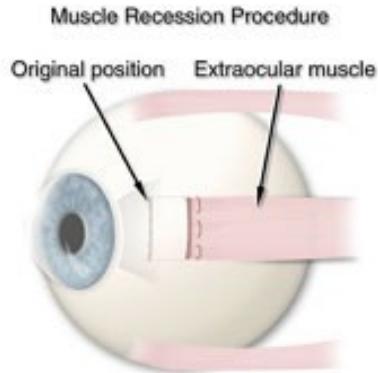
Head tilt test

HETEROPHORIA

- Weakness of BSV without reaching the degree of tropia
- Strongly related to error of refraction
- Common cause for **asthenopia** (**ocular discomfort**)
- Diagnosed by
 - **Cover/uncover test**
 - **Alternate cover test**
- Treated by
 - **Proper refraction**
 - **Prisms in glasses** (exercising and re



STRABISMUS SURGERY



- **Recession** to weaken a muscle
- **Resection** to strengthen the muscle
- Specific for obliques
- **Myotomy** for IO in IO overaction



THANK YOU

